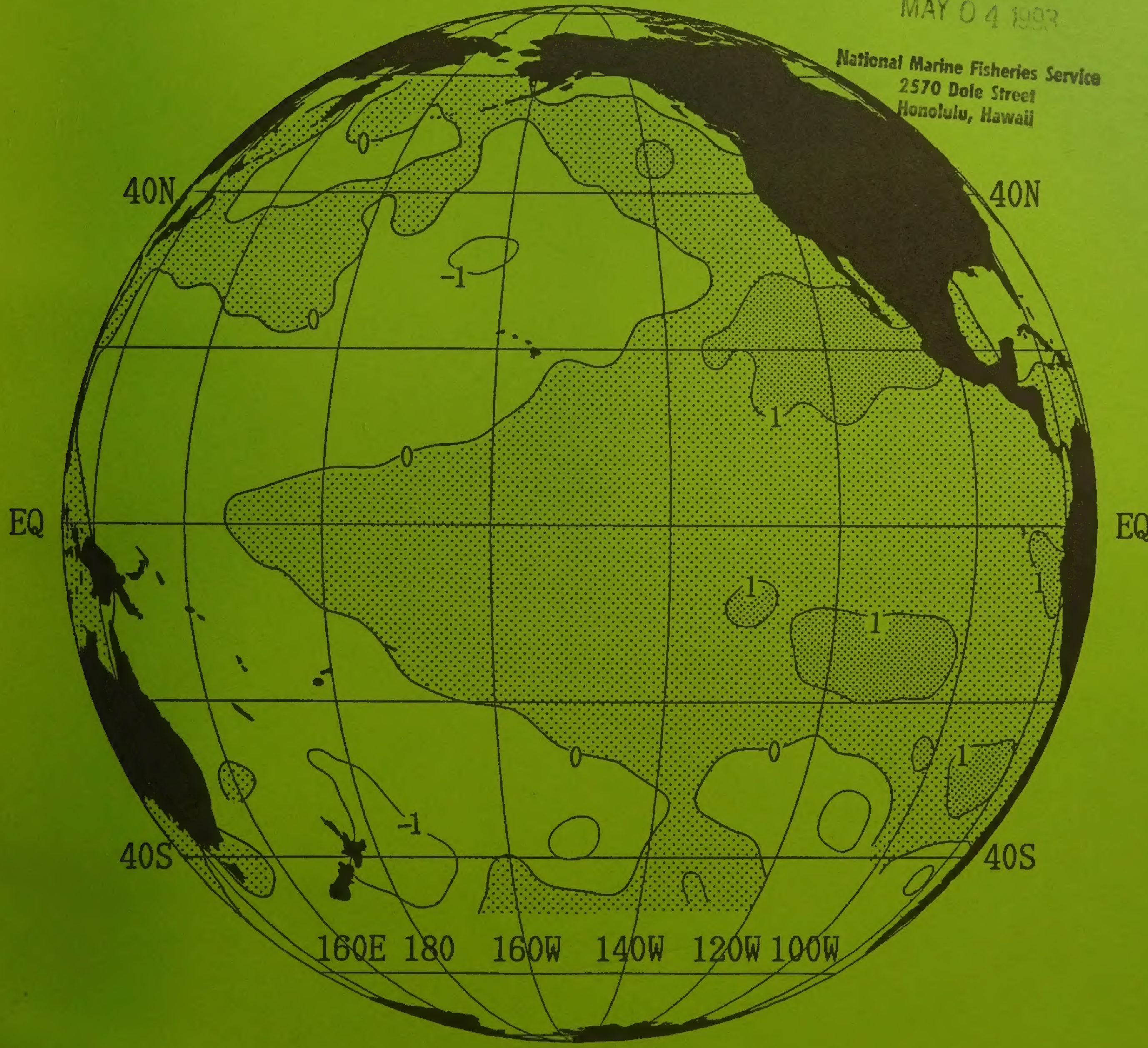
気象庁海洋月報

Monthly Ocean Report

March 1993 (No.3)



El Niño Monitoring Center
Japan Meteorological Agency

気象庁海洋気象部海洋課
エルニーニョ監視センター

平成5年3月

気象庁海洋月報は、気象庁海洋気象部海洋課エルニーニョ監視センターで
作成されています。本月報に関する問い合わせは、
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Monthly Ocean Report is prepared by the El Niño Monitoring Center (ENMOC), Oceanographical Division, Marine Department, Japan Meteorological Agency.

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表紙は1993年３月の太平洋の月平均海面水温偏差図です。
陰影部は平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for March 1993 in the Pacific Ocean. Areas of positive anomalies are shaded.

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海況の特徴（1993年3月）

太平洋の海況

太平洋赤道域の海面水温は、170°E以東で正偏差域が広がり、特にペルー沖及び15°S・120°W付近では1℃以上高かった。エルニーニョ監視海域（4°S-4°N,150°W-90°W）の海面水温の偏差は、+0.5℃と昨年7月以来最も大きくなった（第1表、第1図、第6図）。

赤道域の水温躍層は、西部では依然として浅く、中部では深い状態が続いているが、東部では平年並に近い状態に戻っている（第9図）。

北太平洋の海面水温は、中央部の30°N・165°W付近及び西部熱帯域の140°Eから170°Wにかけての10°Nから20°Nで0.5℃以上低かった。一方、北米沖では正偏差域が広がり、カリフォルニア半島沖で2℃以上、アラスカ湾沖で1℃以上平年より高かった（第1図）。

なお、気象庁の海洋気象観測船「凌風丸」は、日本近海から赤道域に至る137°Eに沿う、海洋と大気間の二酸化炭素の収支も観測しているが、その状況をⅲページに紹介する。この観測によると、この海域は、冬には大気中の二酸化炭素を吸収し、夏には大気中へ二酸化炭素を放出していることがわかる。また、冬の吸収の強さは、夏の放出の強さよりも大きく、年間を通して見ると、海洋は大気中の二酸化炭素を吸収していることがわかった。

日本近海の海況

日本近海の海面水温は、本州東方で平年より0.5℃低いほかは全般に平年より高かった（第17図）。

黒潮は、中旬までは、九州からやや離岸して北東に流れ、足摺岬沖で東北東に向きを変え、紀伊半島の沖80km付近を経て本州の南をほぼ直進し、房総半島沖を東に流れていた。下旬には、紀伊半島の南東沖で蛇行して32.2°N・136.2°Eまで達した後、北東に向かう流路に変化した（第20図）。

本州東方の親潮系の冷水（深さ100mで5℃以下)の沿岸寄りの分枝は38.0°N・142.6°Eまで、沖合の分枝は39.1°N・147.1°Eまでそれぞれ達していた（第19図）。

熱帯の気象

今月も対流活動は中部熱帯太平洋で平年より活発、西部熱帯太平洋で平年より不活発であった（第1表、第13図）。ＳＯＩは-0.5で今月も負の値だった。先月まで負偏差だったタヒチの海面気圧は今月は正偏差となった。上層の200hPaでは日付変更線付近に赤道を挟んで高気圧性の偏差パターンが存在した。下層の850hPaの西太平洋赤道域東西風指数は、今月も弱いながら西風偏差であった（第1表、第12図）。［気象庁長期予報課提供］

HIGHLIGHTS March 1993

Pacific

Sea surface temperatures (SSTs) in the equatorial Pacific were higher than normal east of 170°E. SSTs off Peru and around 15°S,120°W were more than 1°C above normal. The SST index for region B (refer to Fig.6) was +0.5°C which was greater than the values for the last eight consecutive months (Table 1 and Figs.1,6).

The thermocline was still shallower (deeper) than normal in the western (central) equatorial Pacific and near normal in the eastern equatorial Pacific (Fig.9).

In the North Pacific Ocean, SSTs around 30°N,165°W and between 140°E and 170°W from 10°N to 20°N were 0.5°C lower than normal. SSTs off Baja California were 2°C higher and those off the Gulf of Alaska were 1°C higher than normal (Fig.1).

R/V Ryofu Maru has been observing the partial pressure difference of the carbon dioxide between the ocean surface and the atmosphere, which denotes the absorption(release) rate of carbon dioxide from the atmosphere into the ocean. Features of the observation along 137°E in summer 1992 and winter 1993 are shown on page iii (Fig. A).

Seas adjacent to Japan

SSTs were higher than normal in seas adjacent to Japan except for the area east of Honshu where they were 0.5°C lower than normal (Fig.17).

The Kuroshio, which had been flowing NE-ward off Kyushu, straightly ENE-ward off south of Honshu and eastward in the area east off Japan by the middle of March, slightly meandered off the Kii peninsula in the end of March (Fig.20).

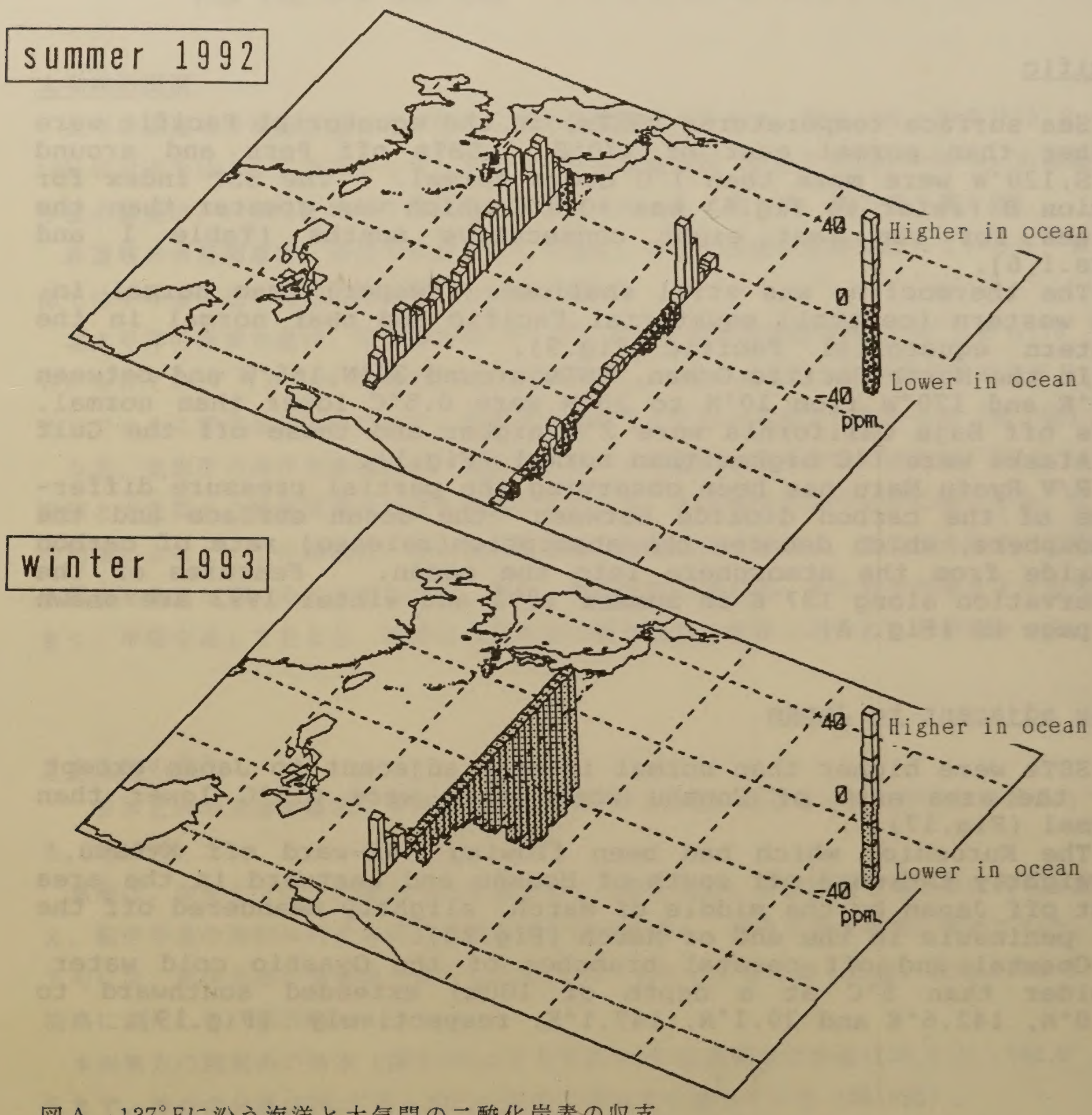
Coastal and off coastal branches of the Oyashio cold water (colder than 5°C at a depth of 100m) extended southward to 38.0°N, 142.6°E and 39.1°N, 147.1°E, respectively (Fig.19).

Atmospheric conditions in the tropics

Convective activity was stronger than normal in the central tropical Pacific and weaker than normal in the western tropical Pacific. These conditions have persisted for few months (Table 1 and Fig.13). The sea level pressure anomaly at Tahiti changed positive but that at Darwin was also large positive. Then, the SOI remained negative (-0.5). The low level easterlies were weaker than normal in the western equatorial Pacific and were nearly normal in the central and eastern equatorial Pacific (Table 1 and Fig.12).

[prepared by the Long-range Forecast Division, JMA]

Difference of pCO_2 between the ocean and the atmosphere along 137°E



図A　137°Eに沿う海洋と大気間の二酸化炭素の収支。
（気象庁凌風丸による1992年夏、1993年冬の観測結果）

Fig.A Difference of partial pressure of CO_2 between the ocean and the atmosphere along 137°E observed by R/V Ryofu Maru in summer 1992 and winter 1993.

In the western North Pacific, CO_2 is absorbed into (released from) the ocean in winter (summer). Larger absorption into the ocean in winter than the release in summer indicates that the ocean should absorb CO_2 in annual average.

Further information is available at the Pollutants Chemical Analysis Center, Oceanographical Division, JMA.

Date		1991 OCT	NOV	1992 DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	1993 DEC	JAN	FEB	MAR
Pacific Sea Surface Temperature (℃)																			
D	(14N~ Eq.)	29.1	29.1	28.6	28.1	28.0	27.9	28.7	29.1	29.4	29.1	29.1	29.2	29.5	29.0	28.7	28.0	28.0	28.2
	(130E~150E)	-0.2	-0.1	-0.3	-0.4	-0.3	-0.5	-0.1	0.0	+0.1	-0.1	0.0	0.0	+0.2	-0.2	-0.2	-0.5	-0.3	-0.2
A	(4N~ 4S)	29.5	29.4	29.4	28.9	29.0	28.9	29.2	29.4	29.2	29.2	29.1	28.8	28.8	28.7	28.8	28.5	28.4	28.4
	(160E~150W)	+1.1	+1.0	+1.2	+0.9	+1.0	+0.8	+1.0	+0.9	+0.7	+0.7	+0.7	+0.5	+0.4	+0.3	+0.6	+0.5	+0.4	+0.3
B	(4N~ 4S)	25.4	25.8	26.1	26.8	27.6	28.0	28.5	28.3	26.9	25.6	24.6	24.5	24.6	24.7	25.0	25.5	26.6	27.4
	(150W~ 90W)	+0.8	+1.2	+1.2	+1.4	+1.4	+1.1	+1.4	+1.7	+0.8	+0.4	0.0	-0.1	0.0	+0.1	+0.1	+0.1	+0.4	+0.5
C	(Eq.~ 10S)	21.2	22.3	23.2	25.1	26.8	27.5	28.0	26.4	23.7	21.6	20.5	20.2	20.8	21.2	22.5	24.3	26.1	27.0
	(90W~ 80W)	+0.5	+0.8	+0.6	+0.8	+1.1	+1.6	+2.9	+2.5	+1.0	0.0	-0.1	-0.1	+0.1	-0.3	-0.1	0.0	+0.4	+1.1
Pacific Sea Level Anomaly (cm)																			
YAP	(10N,138E)	7	6	8	-2	-2	2	1	6	5	-2	-3	2	9	6	8	7	9	
RABAUL	(4S,152E)	-2	-2	-7	-13	-18	-18	-18	-20	-18	-13	-11	-10	-6	-6	-6	-9	-10	
MAJURO	(7N,171E)	-2	-9	-14	-12	-9	-7	0	-2	4	7	7	11	15	6	4	-1	-4	
TARAWA	(1N,173E)	15	14	0	1	-3	-4	-7	-2	-2	2	3	5	2	2	4	1	7	
CHRISTMAS	(2N,157W)	11	10	15	18	15	15	7	5	-3	-2	-7	-4	-3	4	1	5	4	
SANTA CRUZ	(1S, 90W)	5	12	7	18	20	18	8	4	-4	-1	-1	-3	-1	-1	-2	4	8	

第１表 (a) エルニーニョ監視指数

Table 1(a) El Niño monitoring indices. Data sources are the El Niño Monitoring Center, JMA for the sea surface temperature and the SOC of ISLP-PAC, Dept. of Oceanography, University of Hawaii for the sea level anomaly.

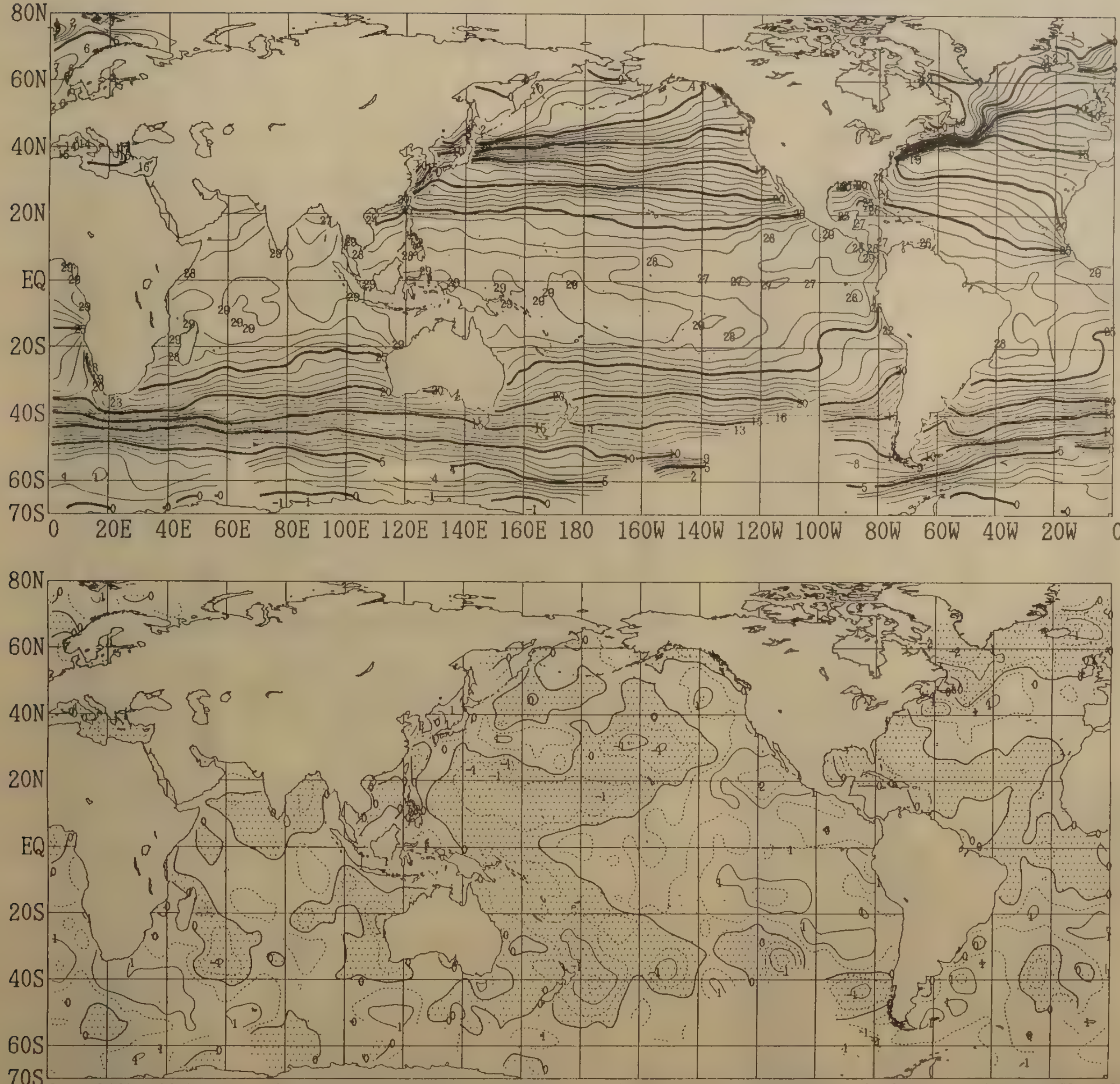
Date	1991 OCT	NOV	1992 DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1993 JAN	FEB	MAR
Southern Oscillation Index (Unit of pressure anomalies at Tahiti and Darwin : hPa)																		
S O I (TAHITI-DARWIN)	-1.5	-0.6	-1.8	-2.5	-0.8	-2.0	-1.6	-0.1	-1.3	-0.5	0.1	-0.0	-2.0	-0.6	-0.5	-0.8	-0.6	-0.5
TAHITI (17.5S , 150W)	-1.7	0.1	-2.1	-1.7	-0.9	-1.5	-0.8	0.0	-1.6	0.7	0.1	-0.8	-2.3	-0.5	-1.1	-1.4	-1.9	1.0
DARWIN (12.5S , 131E)	0.4	1.2	1.0	3.7	1.0	2.8	1.4	0.1	-0.1	1.6	-0.1	-0.8	0.5	0.6	-0.2	0.4	-0.3	2.4
High Cloud Amount Index																		
HCLD-PH (20N ~ 10N) (110E ~ 140E)	-0.5	-1.5	-1.9	-1.0	-1.2	-1.1	-1.0	-1.5	-1.1	-0.3	0.2	-1.6	0.9	-1.7	-1.4	-1.0	-0.3	-0.4
HCLD-MC (5N ~ 5S) (110E ~ 135E)	-1.7	-1.8	-0.7	-2.2	-1.4	-1.4	-1.0	-1.0	-0.7	-0.5	-1.2	-0.4	0.6	-0.8	0.4	-1.1	-0.9	-1.1
HCLD-DL (5N ~ 5S) (170E ~ 170W)	0.4	2.9	1.3	1.6	1.0	1.8	2.3	2.0	1.7	0.0	0.1	-0.6	-0.1	1.3	1.2	0.8	1.4	0.5
Equatorial Zonal Wind Index																		
U200-IN (5N ~ 5S) (80E ~ 100E)	-0.7	0.2	0.6	1.2	-1.3	0.5	0.1	0.6	0.2	-0.4	-0.4	-1.1	-1.4	0.1	0.1	-0.1	0.8	-0.9
U200-CP (5N ~ 5S) (180 ~ 125W)	-0.4	0.0	-0.4	0.0	-0.8	-0.8	-0.9	-1.1	-0.1	0.0	1.1	-0.4	0.7	-0.2	0.7	-0.3	-0.3	0.0
U850-WP (5N ~ 5S) (160E ~ 175W)	0.1	1.6	1.4	1.8	0.6	1.0	0.9	0.6	0.1	0.1	-0.4	0.2	0.2	0.4	0.8	0.3	0.9	0.3
U850-CP (5N ~ 5S) (170W ~ 135W)	0.7	0.9	1.0	1.8	0.8	1.1	0.8	0.9	0.1	0.3	-0.7	0.5	-0.4	0.9	0.2	0.2	0.0	-0.1
U850-EP (5N ~ 5S) (130W ~ 100W)	0.3	0.4	-0.3	1.6	0.0	0.3	0.2	0.5	0.4	-0.1	-0.9	0.6	-1.2	1.9	-0.0	0.1	-0.1	0.2

第１表 (b) エルニーニョ監視指数(続き)

Table 1(b) El Niño monitoring indices (continued) .

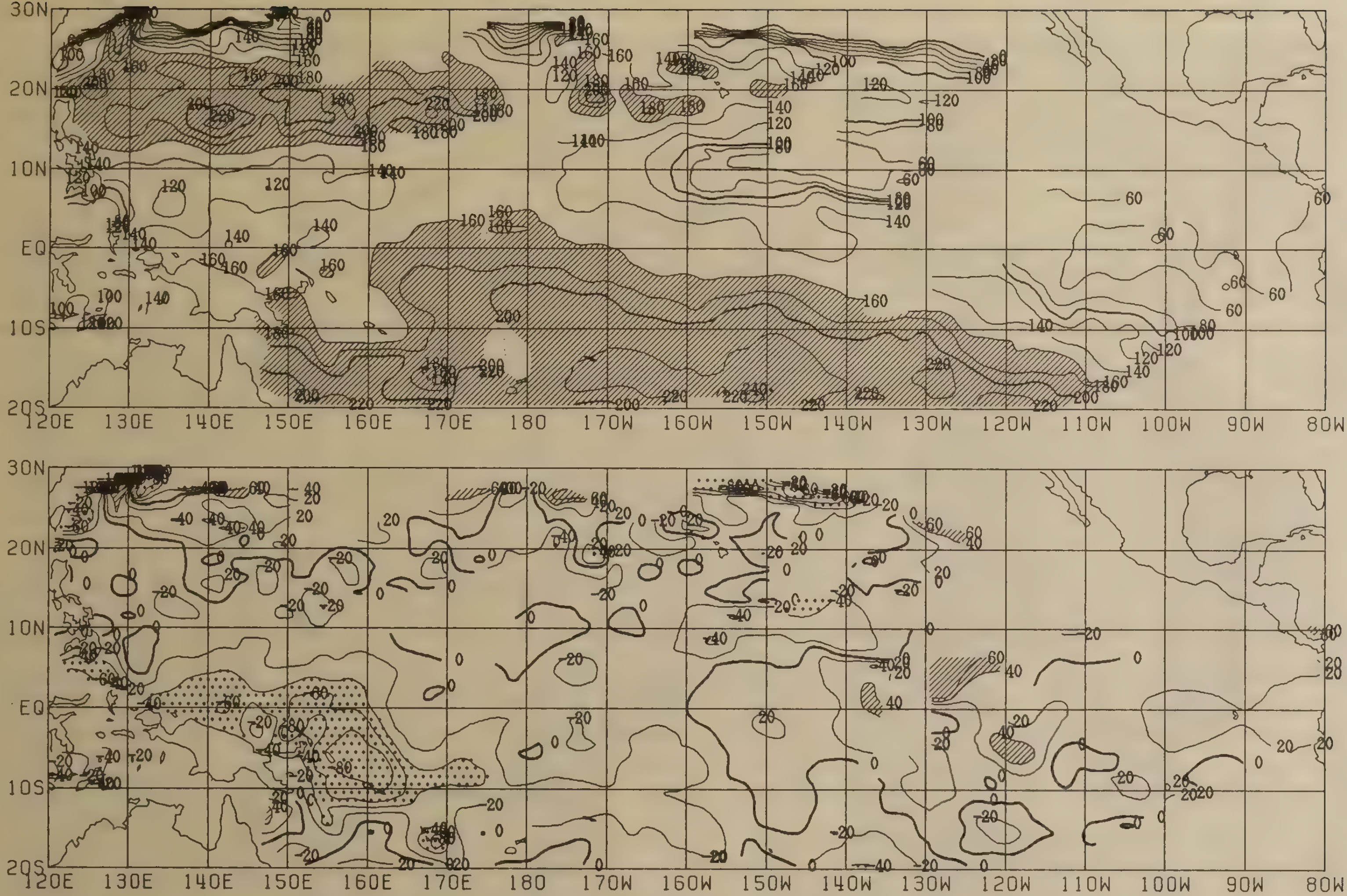
Data source for these atmospheric conditions is the Long-range Forecast Division, JMA.

SST & Anomalies in the Global Ocean



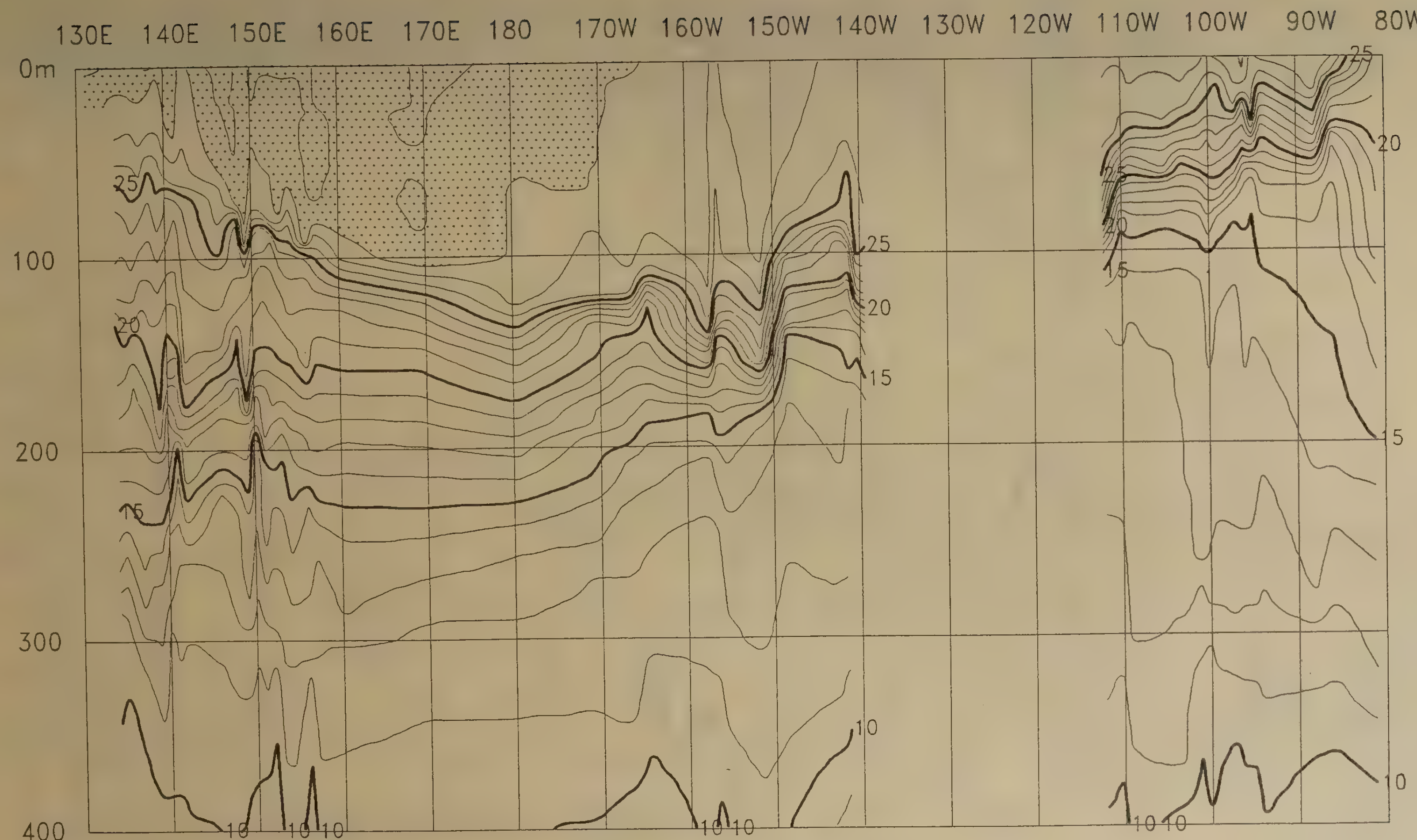
第１図　全球月平均海面水温図（上）及び偏差図（下）（1993年 3月）

Fig.1　Monthly mean sea surface temperature in the global ocean (top) and anomalies (bottom) for MAR 1993.　Anomalies are computed with respect to the JMA climatology (1961–90) (Climatic charts of sea surface temperatures of the western North Pacific and the global ocean, March 1991).　The Contour interval is 1° C and additional anomaly contours of ±0.5° C are shown as broken lines.　Negative anomalies are stippled.



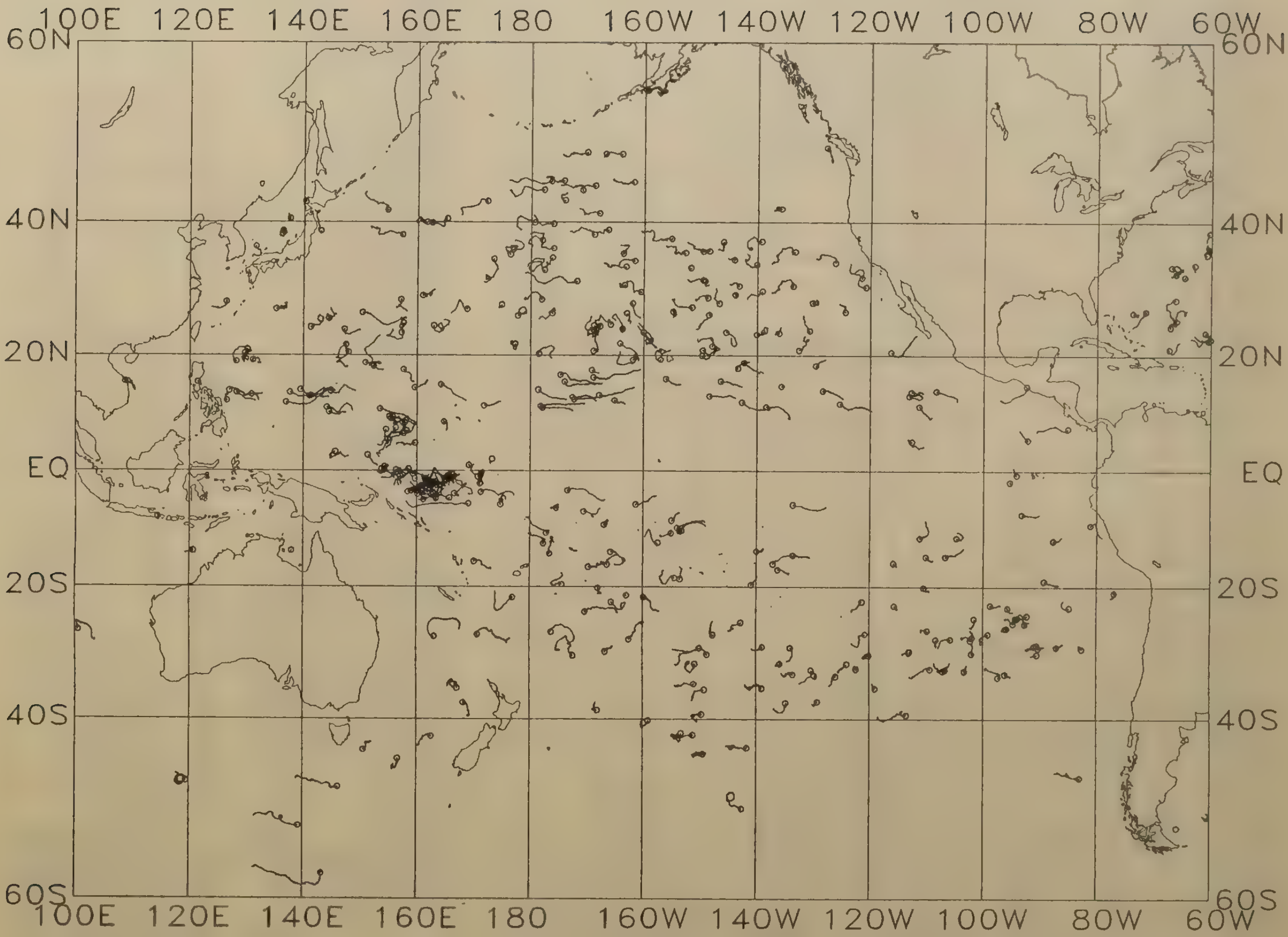
第２図　太平洋表層水温（20℃深度）図（上）及び偏差図（下）（1993年 3月）
Fig.2 The depth of a 20° C isotherm in the Pacific Ocean (top) and anomalies (bottom) for MAR 1993. Anomalies are computed with respect to the climatology (Levitus, 1982, Climatological Atlas of the World Ocean, NOAA).
The contour interval is 20m with shading for values greater than 160m (top), and shading/stippling for values greater/smaller than +40m/−40m (bottom).

Depth–Longitude Section of Ocean Temperature



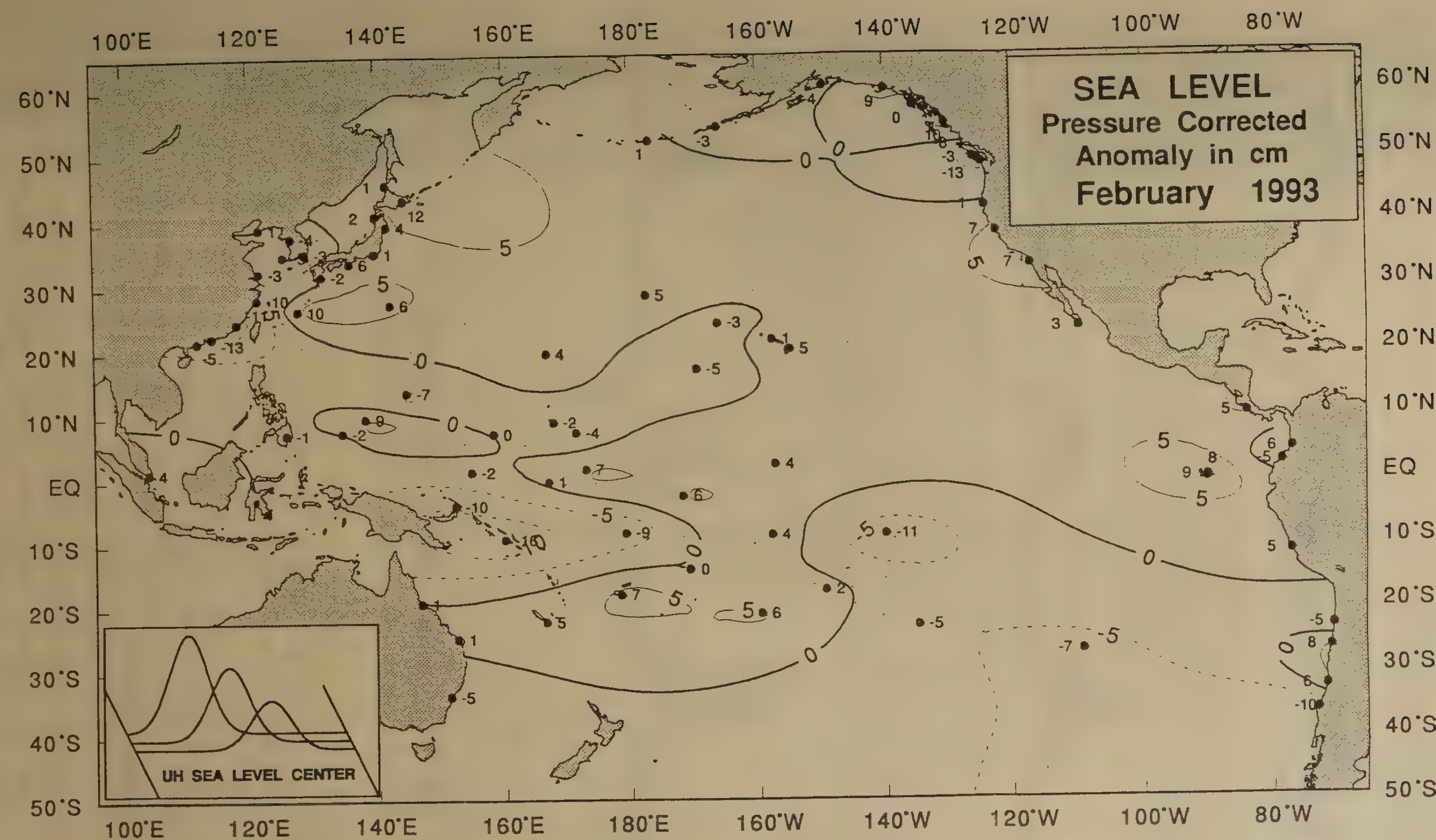
第３図　太平洋赤道に沿う表層水温断面図（1993年 3月）

Fig.3 Depth–longitude section of the Pacific Ocean temperature along the equator for MAR 1993. The contour interval is 1° C with spotted shading for values greater than 28° C.



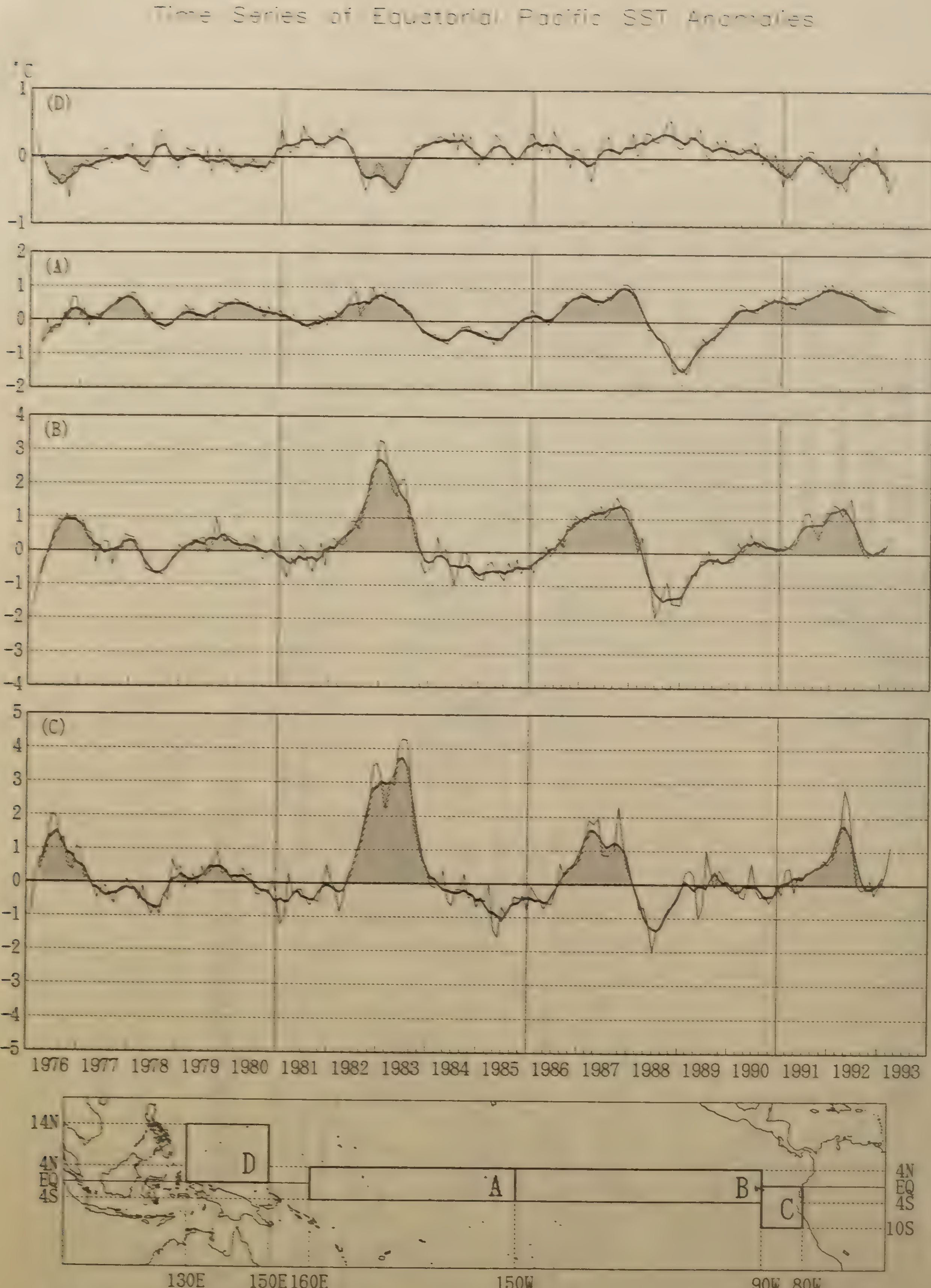
第4図　太平洋ブイ流跡図(1993年 3月)

Fig.4 Movements of drifting buoys in the Pacific Ocean during MAR 1993. Each track is one buoy, with the small circle representing the buoy's last position for the month.



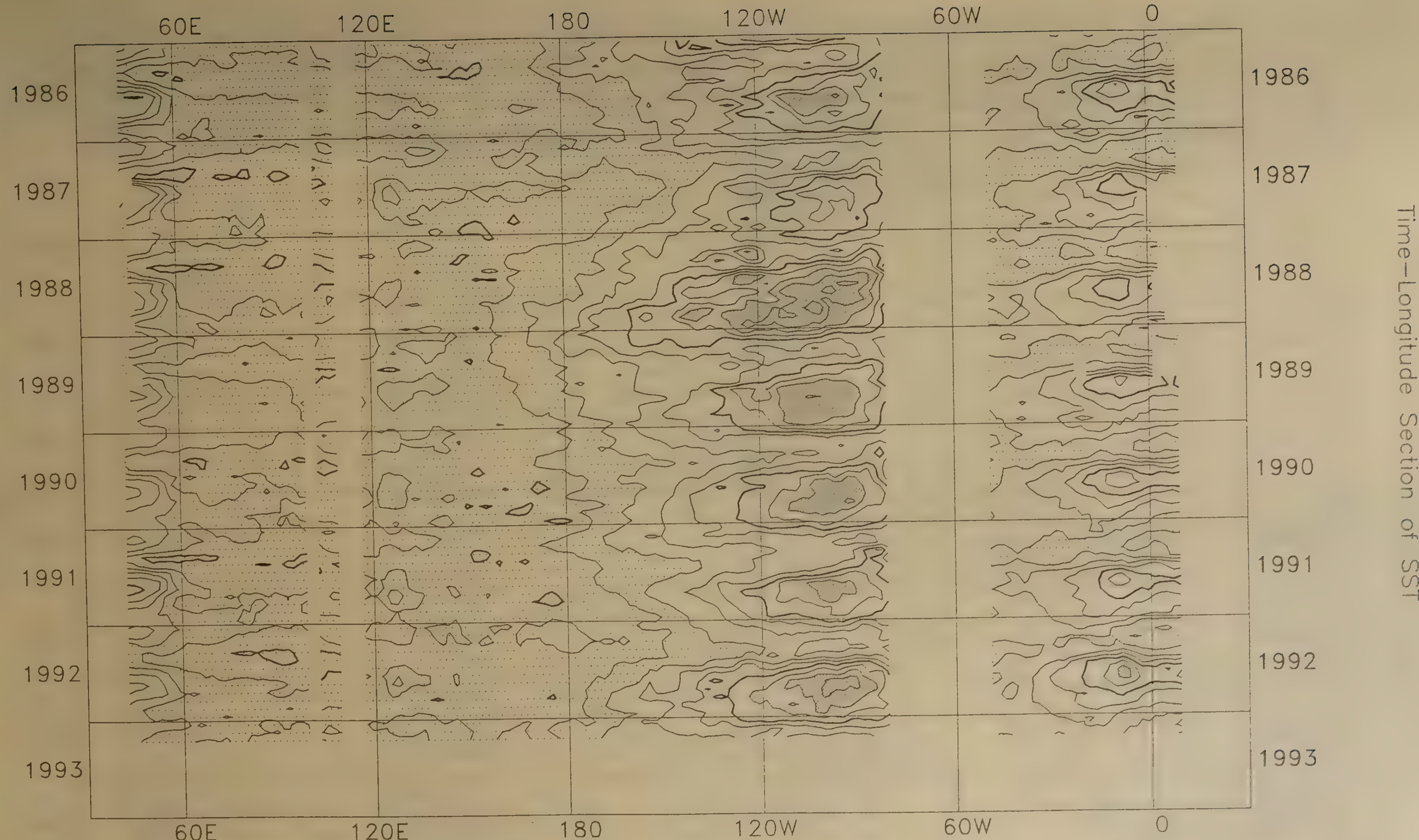
第5図　太平洋海面水位偏差図（ 1993年 2月 ）

Fig.5 Sea level anomalies obtained from the 1975 to 1986 mean FEB sea level adjusted for atmospheric pressure (FEB 1993).
This figure is prepared by the SOC of ISLP–PAC, Dept. of Oceanography, Univ. of Hawaii.



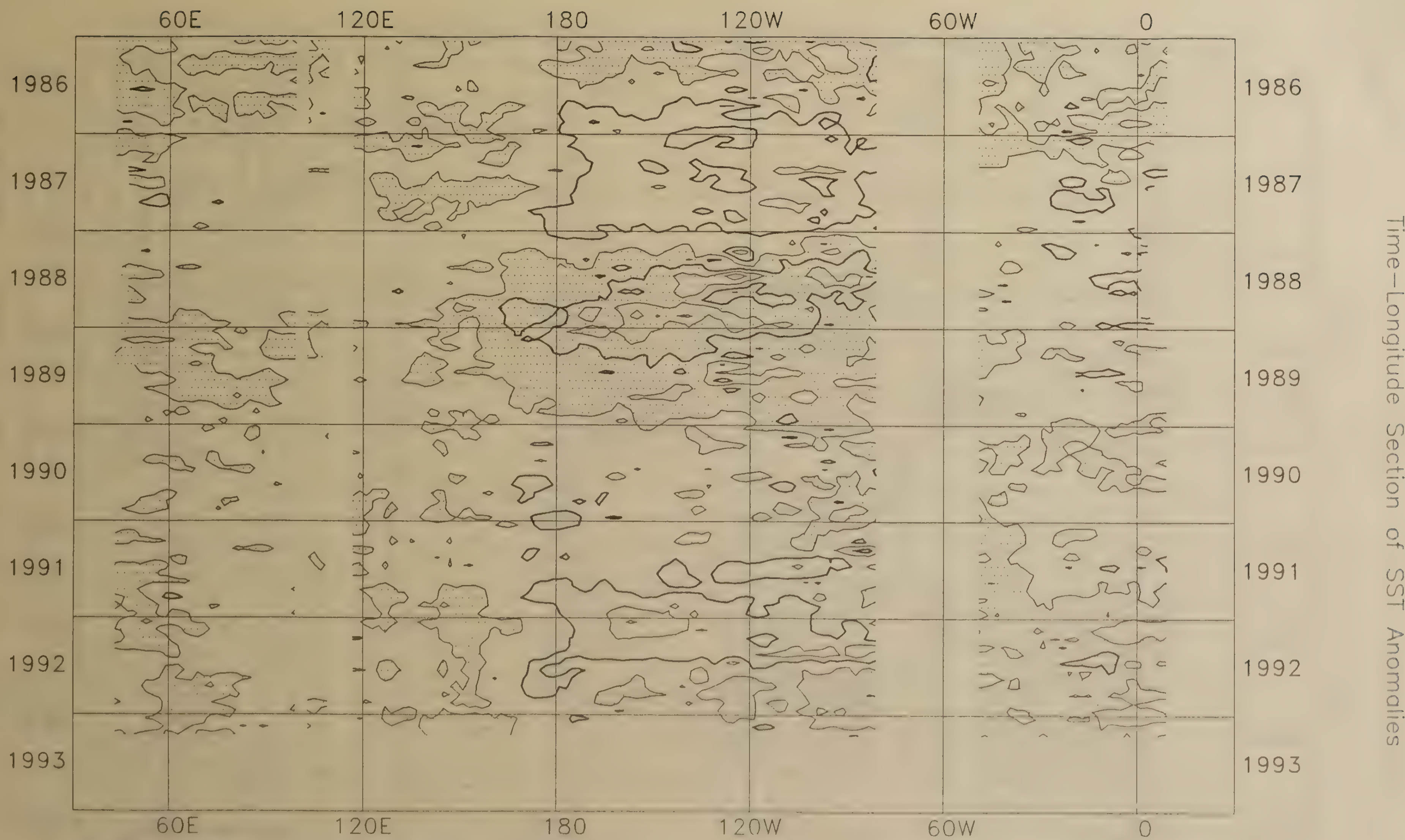
第６図　赤道太平洋海面水温偏差時系列図

Fig.6 Time series of monthly mean SST anomalies in the equatorial Pacific Ocean for the areas indicated at the bottom of the figure. Thin lines show the monthly values and thick lines their 5 month running mean. Positve anomalies (A,B,C) and negative anomalies (D) are shaded. Anomalies are computed with respect to the JMA climatology (1961–90).



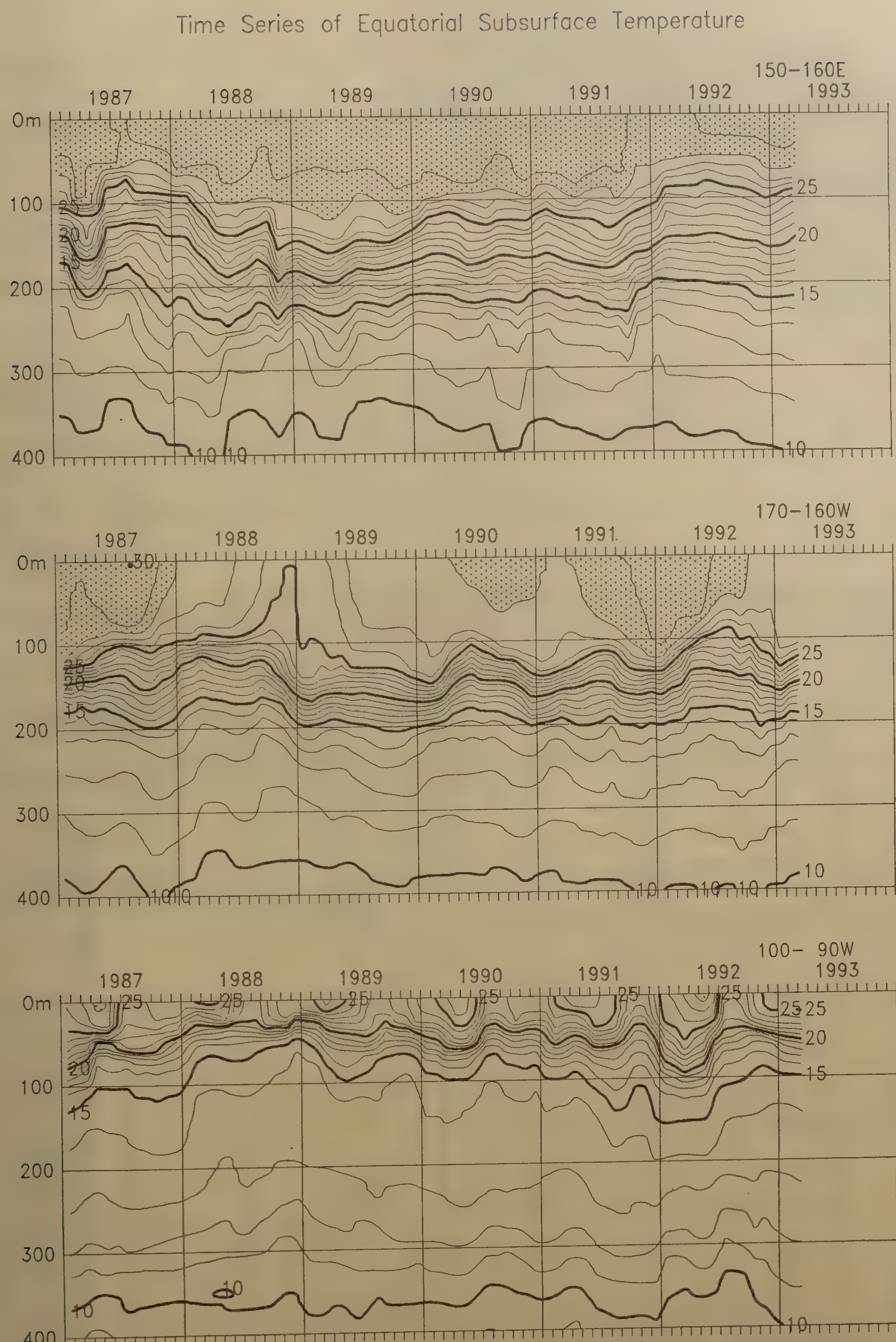
第7図　赤道に沿う海面水温時系列図

Fig.7 Time-longitude section of SSTs along the equator (2° N–2° S) in the global ocean. The contour interval is 1° C, with thick contour lines at 25 and 30° C. SST values greater than 28° C are spotted and values less than 23° C are shaded.



第8図　赤道に沿う海面水温偏差時系列図

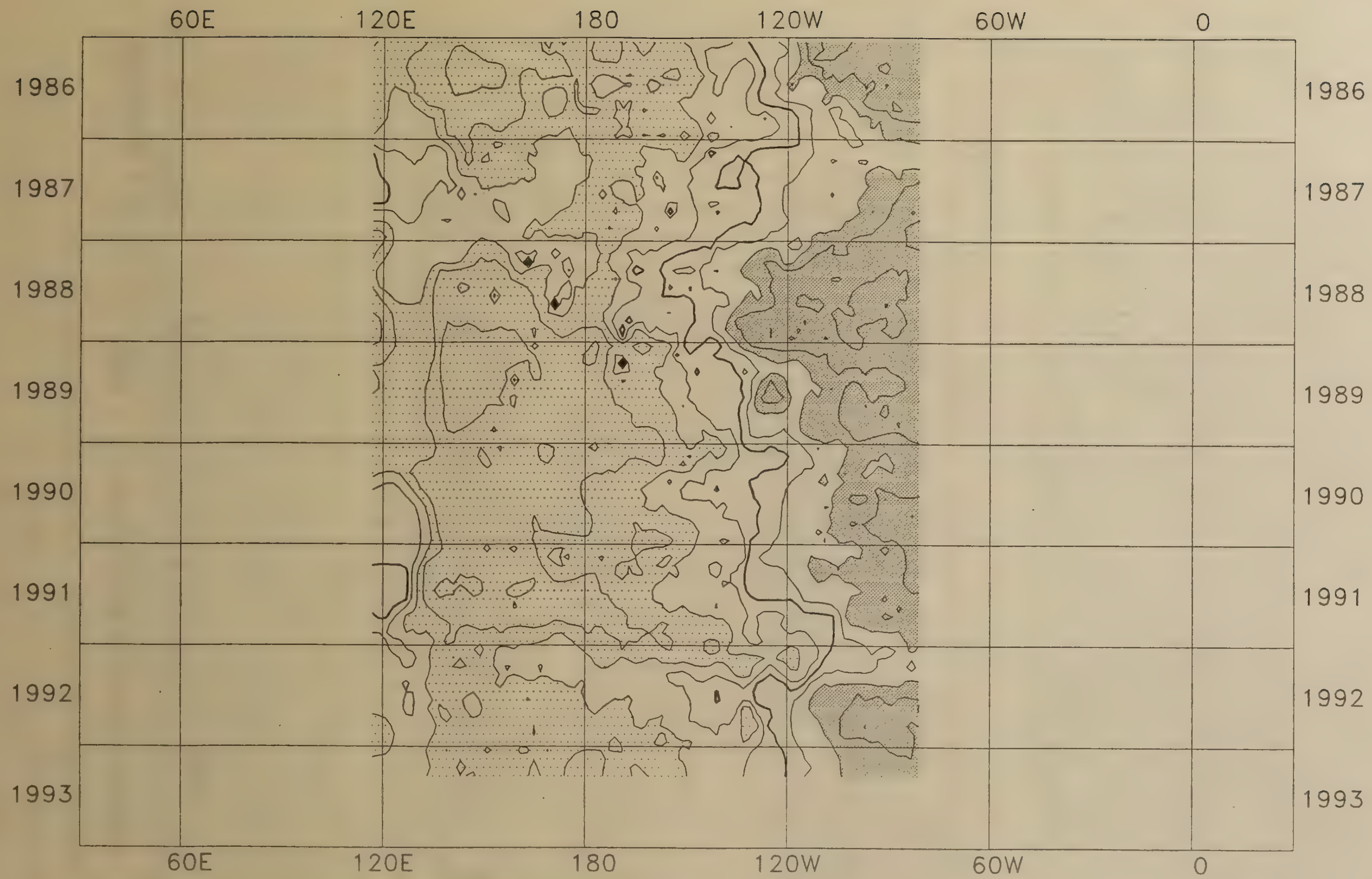
Fig.8 Time-longitude section of SST anomalies along the equator (2° N−2° S) based on the JMA climatology (1961−1990). The contour interval is 1° C, with thick contour lines at +1° C and −1° C. Negative anomalies are spotted.



第９図　赤道太平洋表層水温時系列図（上：西部、中：中部、下：東部）

Fig.9 Time series of equatorial (2° N-2° S) subsurface temperature for the western Pacific (top, 150-160° E), the central Pacific (middle, 170-160° W) and the eastern Pacific (bottom, 100-90° W). The contour interval is 1° C with spotted shading for the values greater than 28° C.

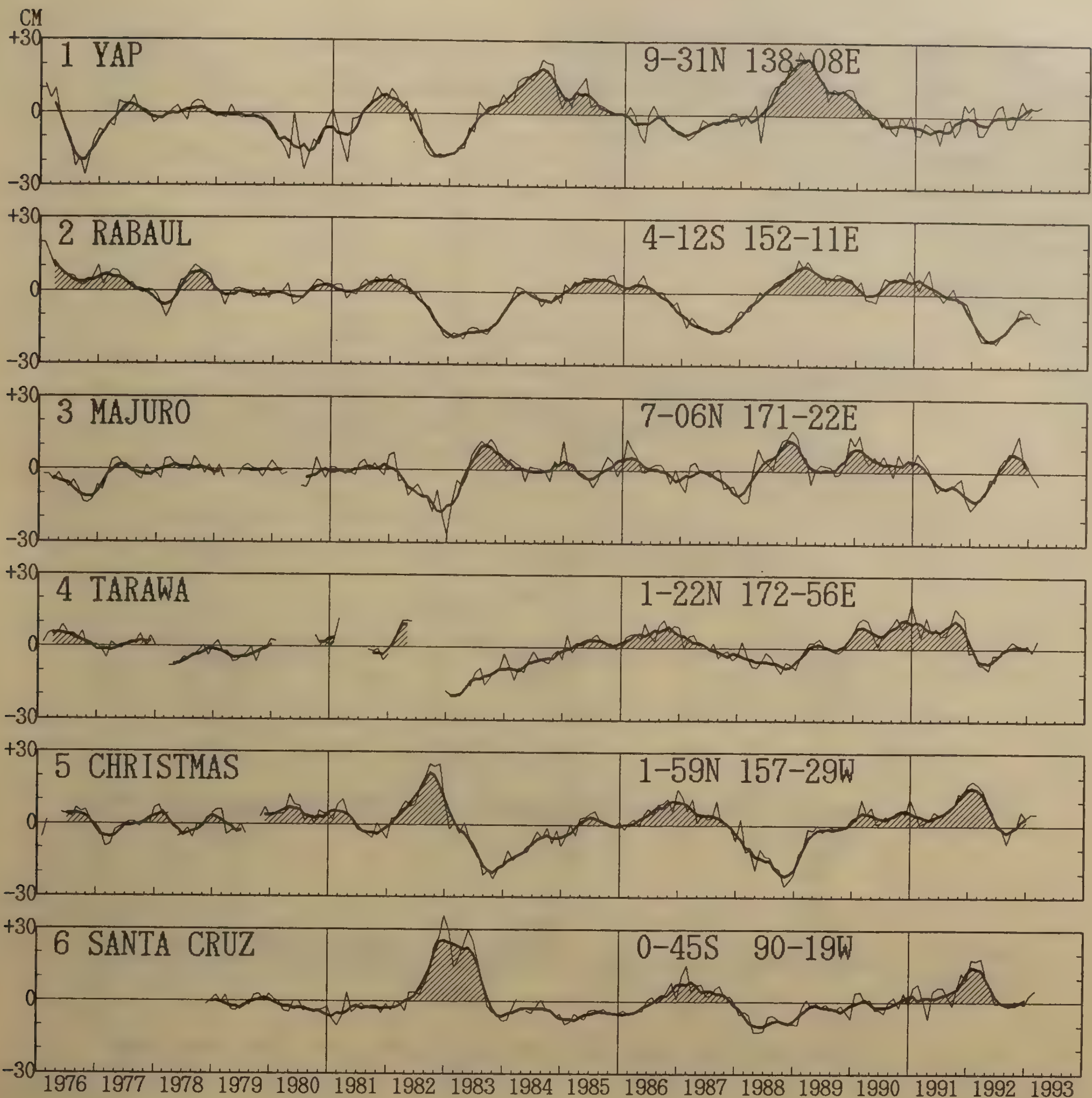
Time–Longitude Section of the Depth of 20° C

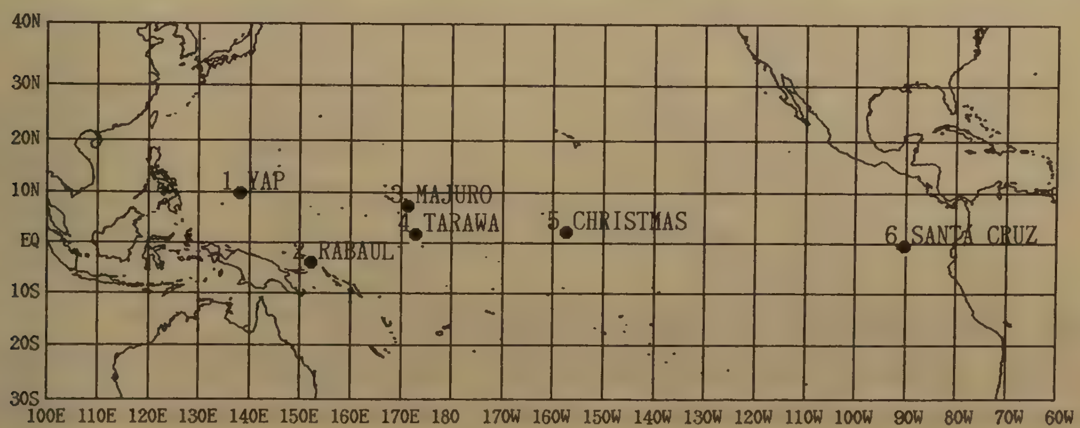


第10図　太平洋の赤道に沿う20℃深度時系列図

Fig.10 Time–longitude section of the depth of a 20° C isotherm along the equator in the Pacific Ocean. The contour interval is 20m with thick contour lines at 100m. Values shallower than 60m are shaded and those deeper than 140m are stippled.

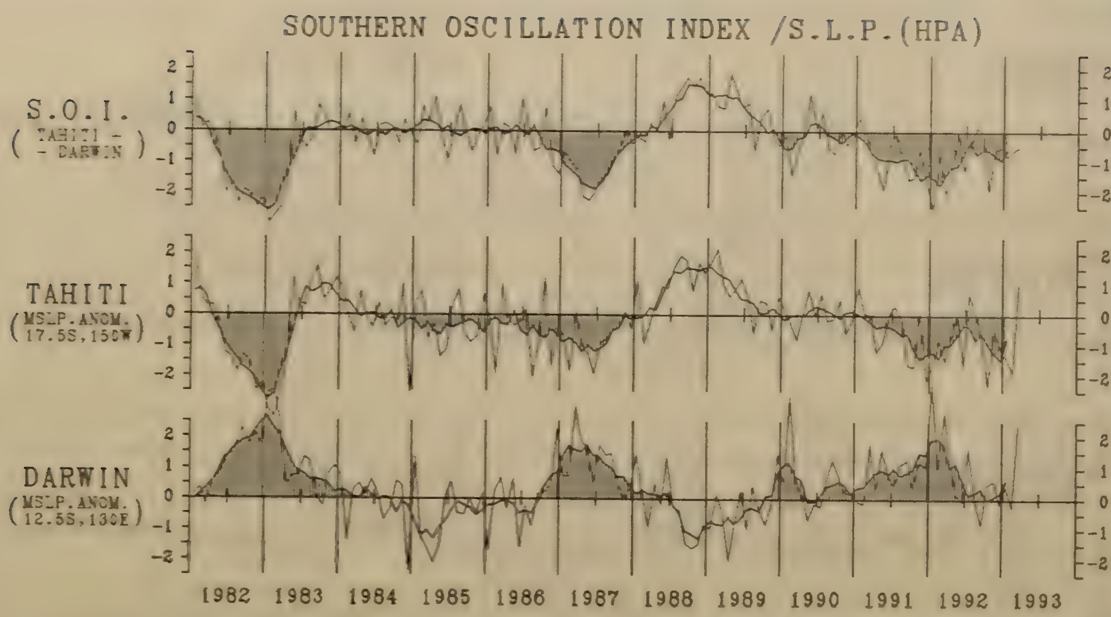
Time series of Sea Level Anomalies





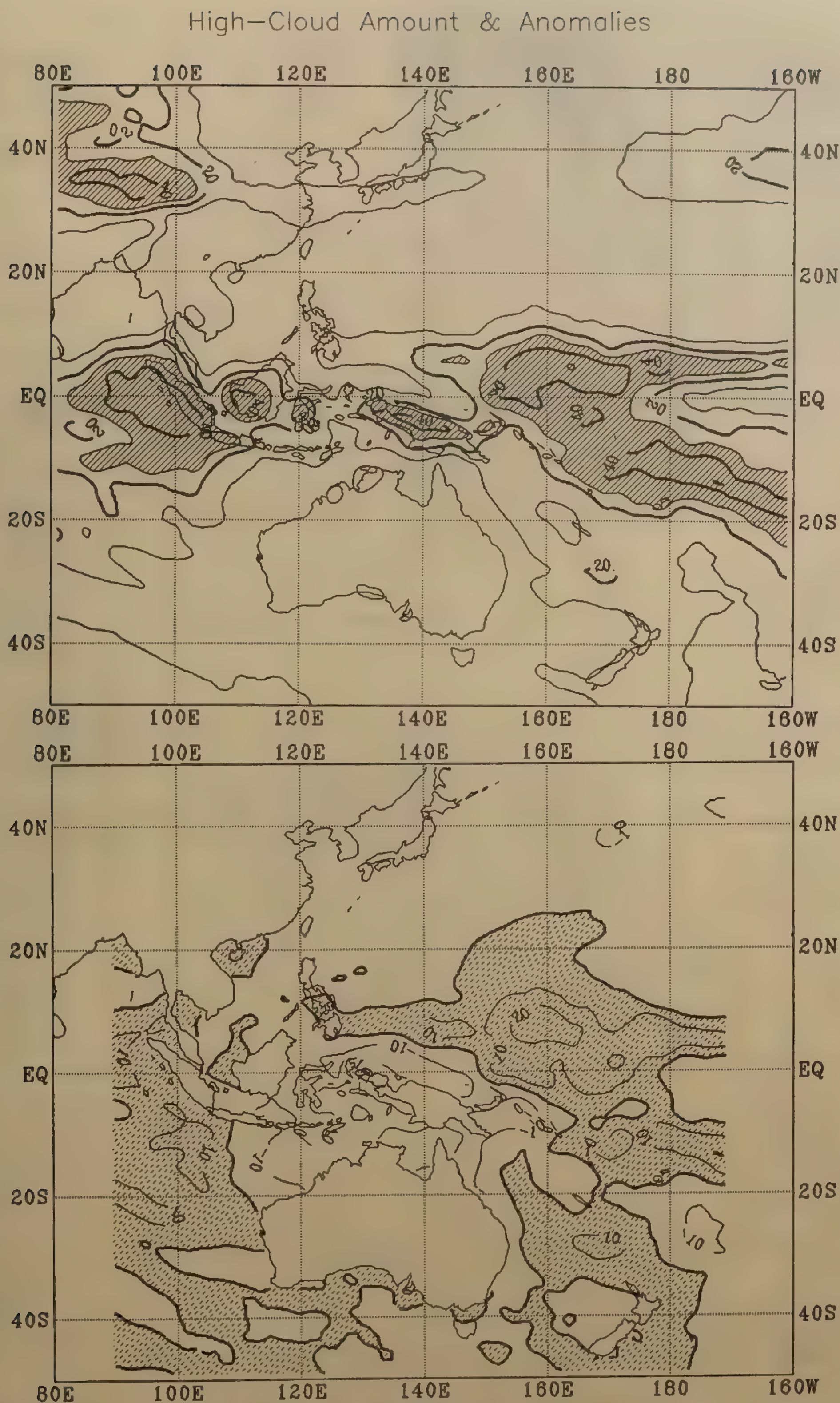
第11図　太平洋月平均海面水位偏差時系列図
Fig.11 Time series of sea level anomalies based on 1976 to 1990 monthly mean sea level obtained from the stations indicated at the bottom of the figure. Thin lines show the monthly mean and thick lines show their 5 month running mean. Positive anomalies are shaded.

Time series of SOI & Sea Level Pressure Standardized Anomalies



第12図　南方振動指数及び海面気圧偏差時系列図

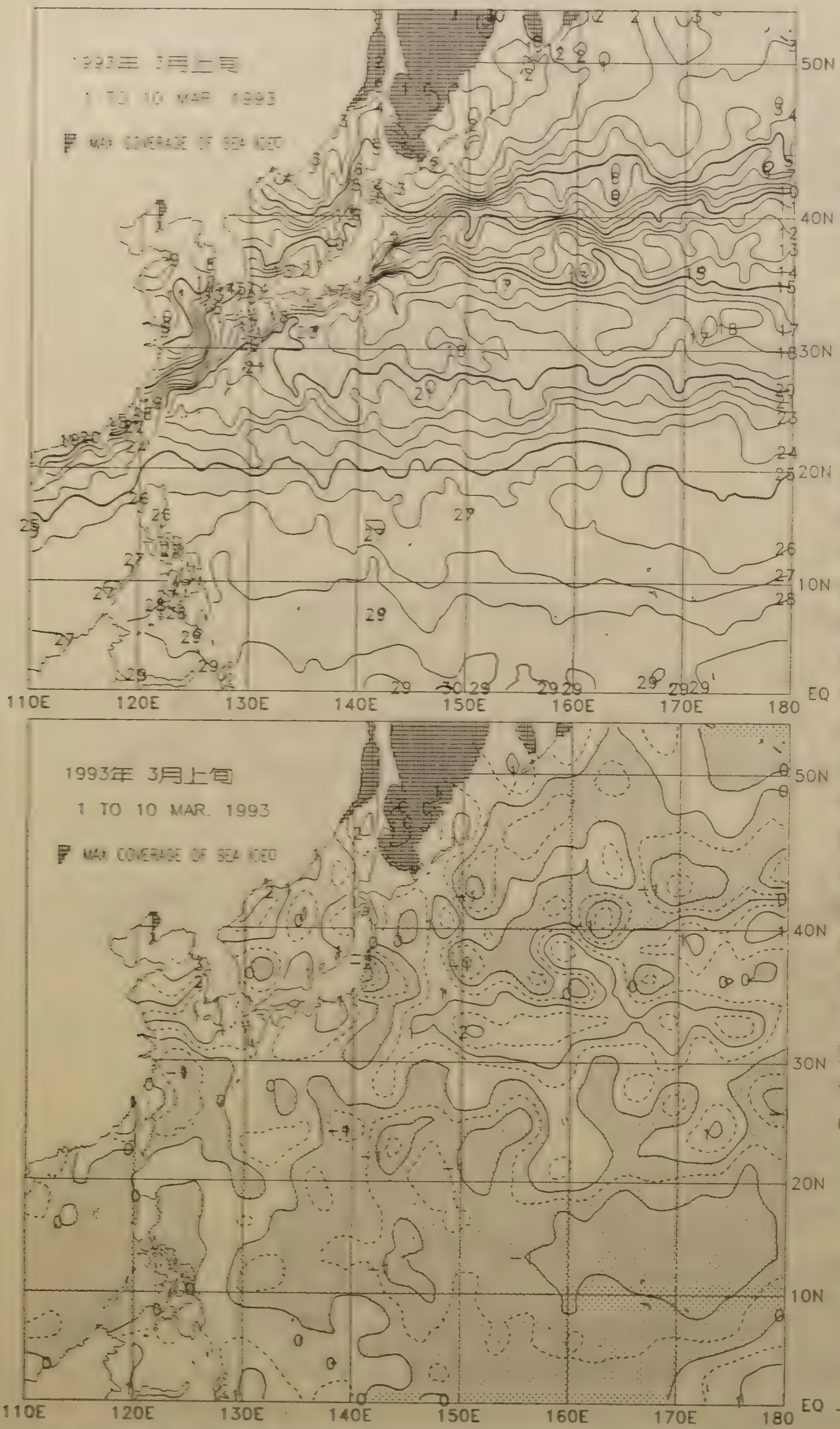
Fig.12 The Southern Oscillation Index (top) and monthly mean sea level pressure standardized anomalies at Tahiti (middle) and Darwin (bottom). Thin lines show the monthly mean and thick lines their 5 month running mean. Negative values (top, middle) and positive values (bottom) are shaded. Base periods for normals and standard deviations are 1961−1990. This figure is prepared by the Long−range Forecast Division, JMA.



第13図　月平均上層雲量分布図及び偏差図（1993年 3月）

Fig.13 Monthly mean of the high-cloud amount (%, top) and its anomalies (%, bottom) in the equatorial Pacific for MAR 1993. The contour interval is 10%. Areas above 30% are shaded (top) and positive anomalies are stippled (bottom). Anomalies represent a departure from the 1978–1990 base period monthly means. This figure is prepared by the Long-range Forecast Division, JMA.

Ten-day mean SST & Anomalies



旬平均沿岸水温(℃)
Coastal Water Temperature

地名 (Index Number)	水温 Temp.	偏差 Anom.
石垣島(47918)	21.7	+0.5
那　覇(47936)	21.1	+0.9
名　瀬(47909)	20.0	-
足摺岬(47898)	15.6	−0.1
潮　岬(47778)	16.0	-
御前崎(47655)	12.4	+1.3
八丈島(47678)	18.0	+1.5
館　山(47672)	13.3	0.0
小名浜(47598)	8.2	−0.6
宮　古(47585)	7.6	+1.7
浦　河(47426)	1.6	+0.7
紋　別(47435)	−0.5	-
稚　内(47401)	1.8	-
寿　都(47421)	7.2	-
江　差(47428)	7.0	-
飛　島(47587)	9.4	+1.2
輪　島(47600)	8.5	+0.6
西　郷(47740)	12.1	-
浜　田(47755)	11.6	-
厳　原(47800)	13.7	-
牛　深(47838)	16.3	-

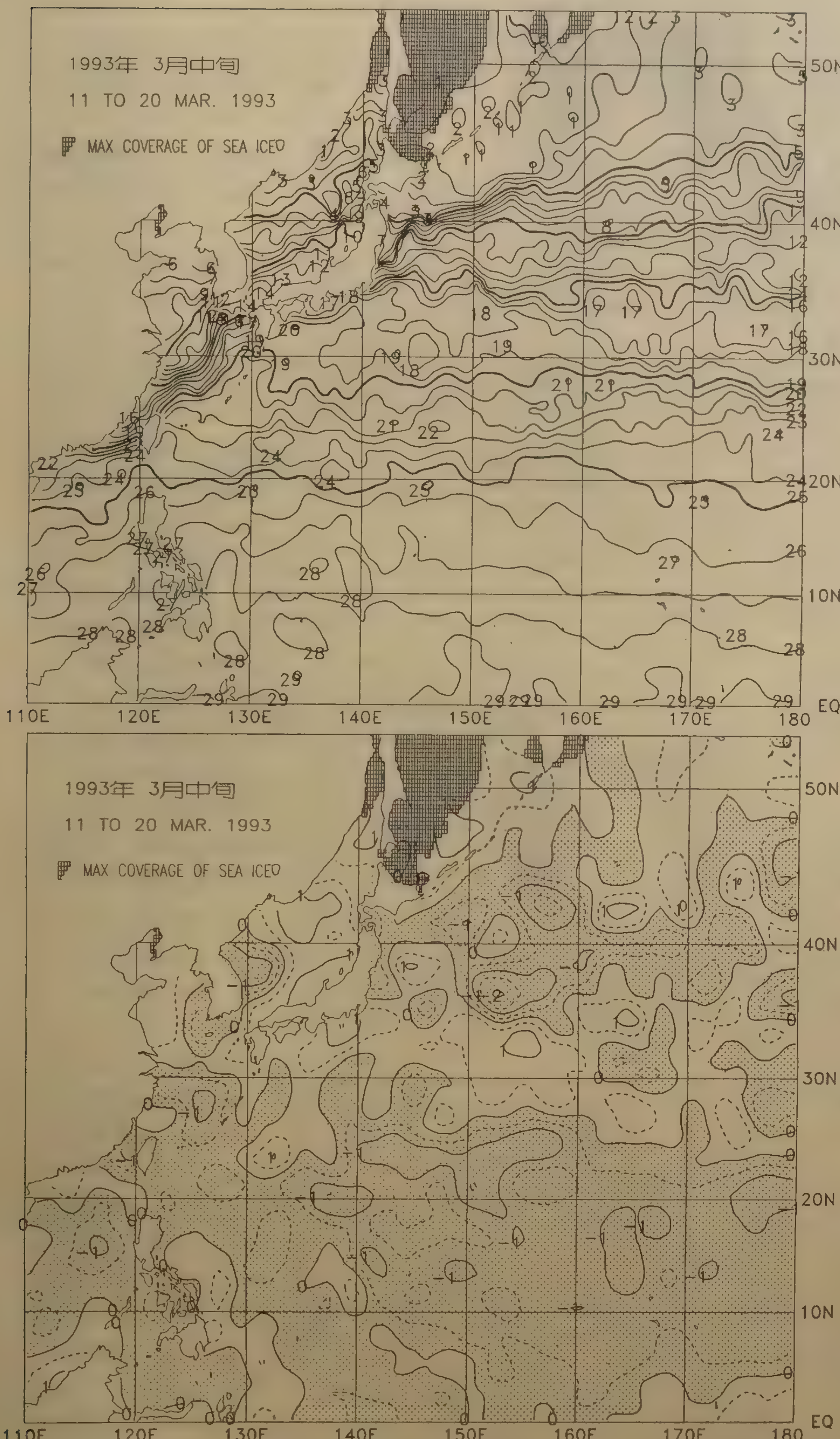
海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,145.4E	11.3
四国沖	29.0N,135.0E	19.7
東シナ海	28.2N,126.3E	20.3

第14図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1993年 3月上旬)

Fig.14 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 1st ten-day period in MAR 1993. Anomalies are computed with respect to the JMA climatology (1961−90). The contour interval is 1° C and additional anomaly contours of 0.5° C are shown. Negative anomalies are stippled.

Ten-day mean SST & Anomalies



旬平均沿岸水温(℃)
Coastal Water Temperature

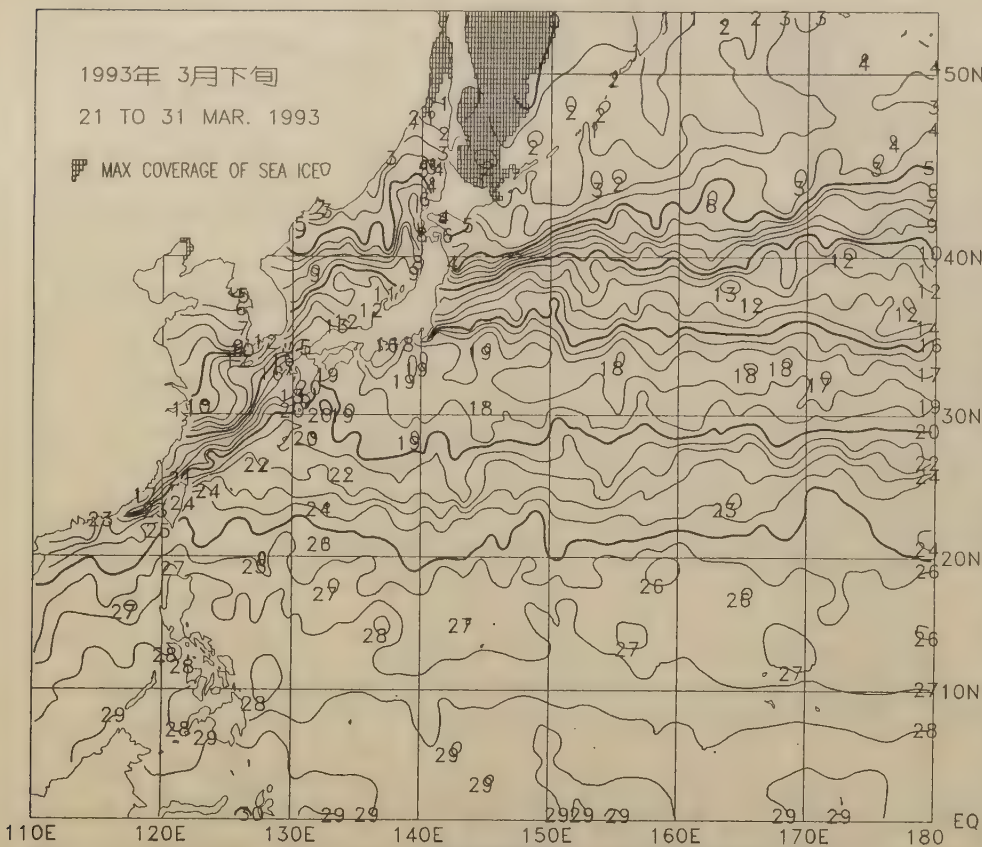
地名 (Index Number)	水温 Temp.	偏差 Anom.
石垣島 (47918)	21.9	0.0
那覇 (47936)	21.2	+0.2
名瀬 (47909)	20.2	-
足摺岬 (47898)	16.1	+0.1
潮岬 (47778)	15.7	-
御前崎 (47655)	13.0	+1.2
八丈島 (47678)	17.9	+0.7
館山 (47672)	13.6	0.0
小名浜 (47598)	7.9	−1.0
宮古 (47585)	7.9	+2.3
浦河 (47426)	1.8	+0.3
紋別 (47435)	0.6	-
稚内 (47401)	1.8	-
寿都 (47421)	6.8	-
江差 (47428)	7.8	-
飛島 (47587)	9.0	+0.5
輪島 (47600)	8.4	0.0
西郷 (47740)	12.6	-
浜田 (47755)	12.4	-
厳原 (47800)	14.2	-
牛深 (47838)	15.9	-

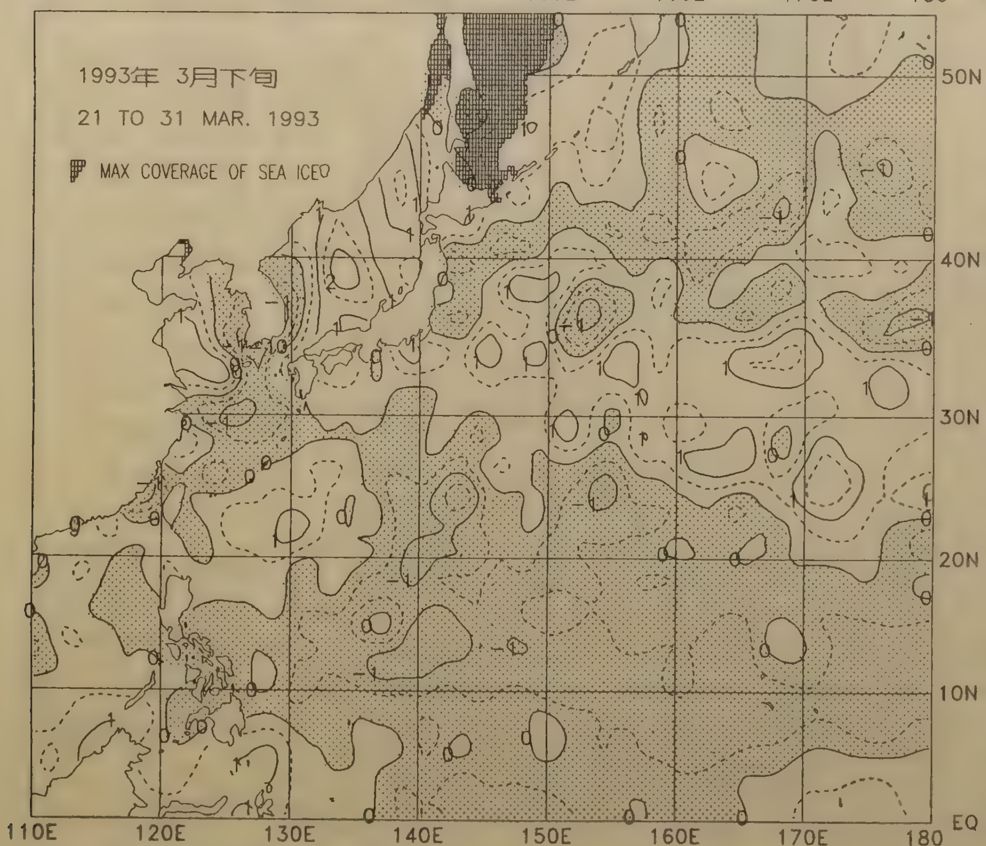
海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,145.4E	11.1
四国沖	29.0N,135.0E	19.8
東シナ海	28.2N,126.3E	18.3

第15図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1993年 3月中旬)

Fig.15 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 2nd ten-day period in MAR 1993. Anomalies are computed with respect to the JMA climatology (1961−90). The contour interval is 1°C and additional anomaly contours of 0.5°C are shown. Negative anomalies are stippled.





旬平均沿岸水温(℃)
Coastal Water Temperature

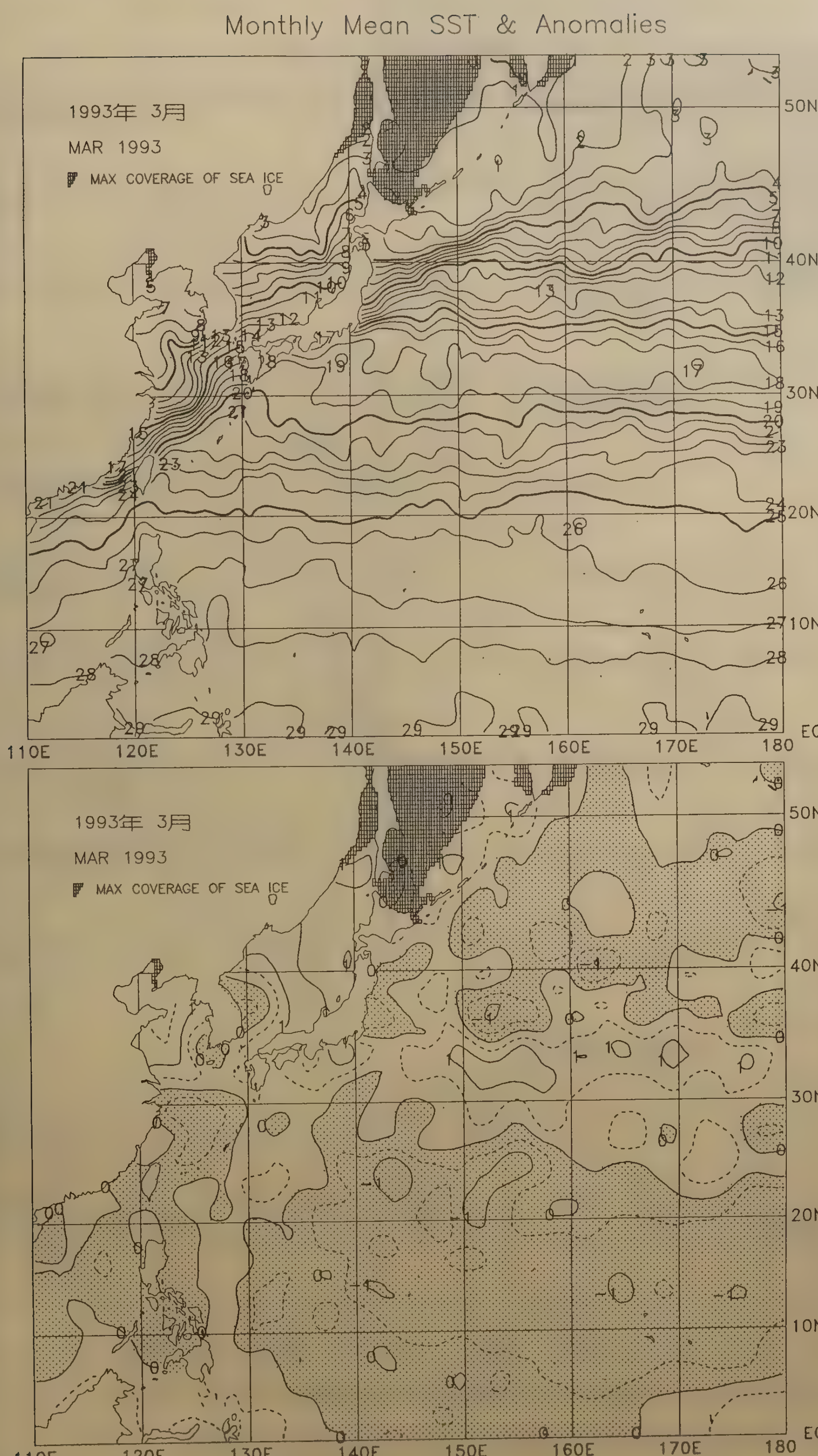
地名 (Index Number)	水温 Temp.	偏差 Anom
石垣島(47918)	23.1	+0.8
那　覇(47936)	22.1	+1.1
名　瀬(47909)	20.3	-
足摺岬(47898)	17.1	+0.7
潮　岬(47778)	-	-
御前崎(47655)	13.8	+1.1
八丈島(47678)	18.2	+0.7
館　山(47672)	14.8	+0.7
小名浜(47598)	8.3	−0.6
宮　古(47585)	8.0	+2.3
浦　河(47426)	3.0	+1.4
紋　別(47435)	0.3	-
稚　内(47401)	3.5	-
寿　都(47421)	7.2	-
江　差(47428)	8.1	-
飛　島(47587)	10.2	+1.3
輪　島(47600)	9.5	+0.4
西　郷(47740)	12.8	-
浜　田(47755)	13.1	-
厳　原(47800)	14.5	-
牛　深(47838)	16.2	-

海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,145.4E	10.9
四国沖	29.0N,135.0E	20.3
東シナ海	28.2N,126.3E	20.0

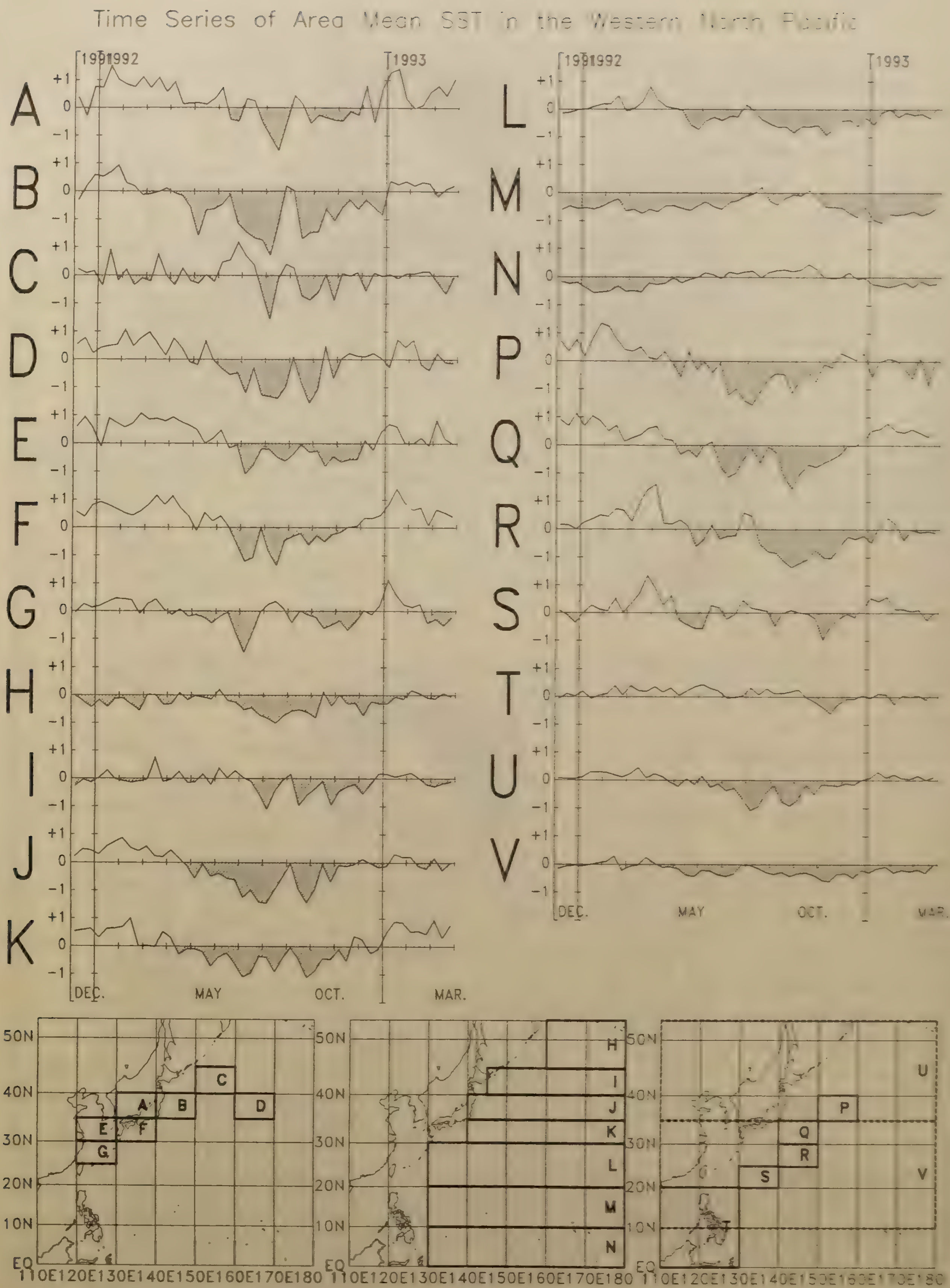
第16図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1993年 3月下旬)

Fig.16 Ten–day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 3rd ten–day period in MAR 1993. Anomalies are computed with respect to the JMA climatology (1961–90). The contour interval is 1° C and additional anomaly contours of 0.5° C are shown. Negative anomalies are stippled.



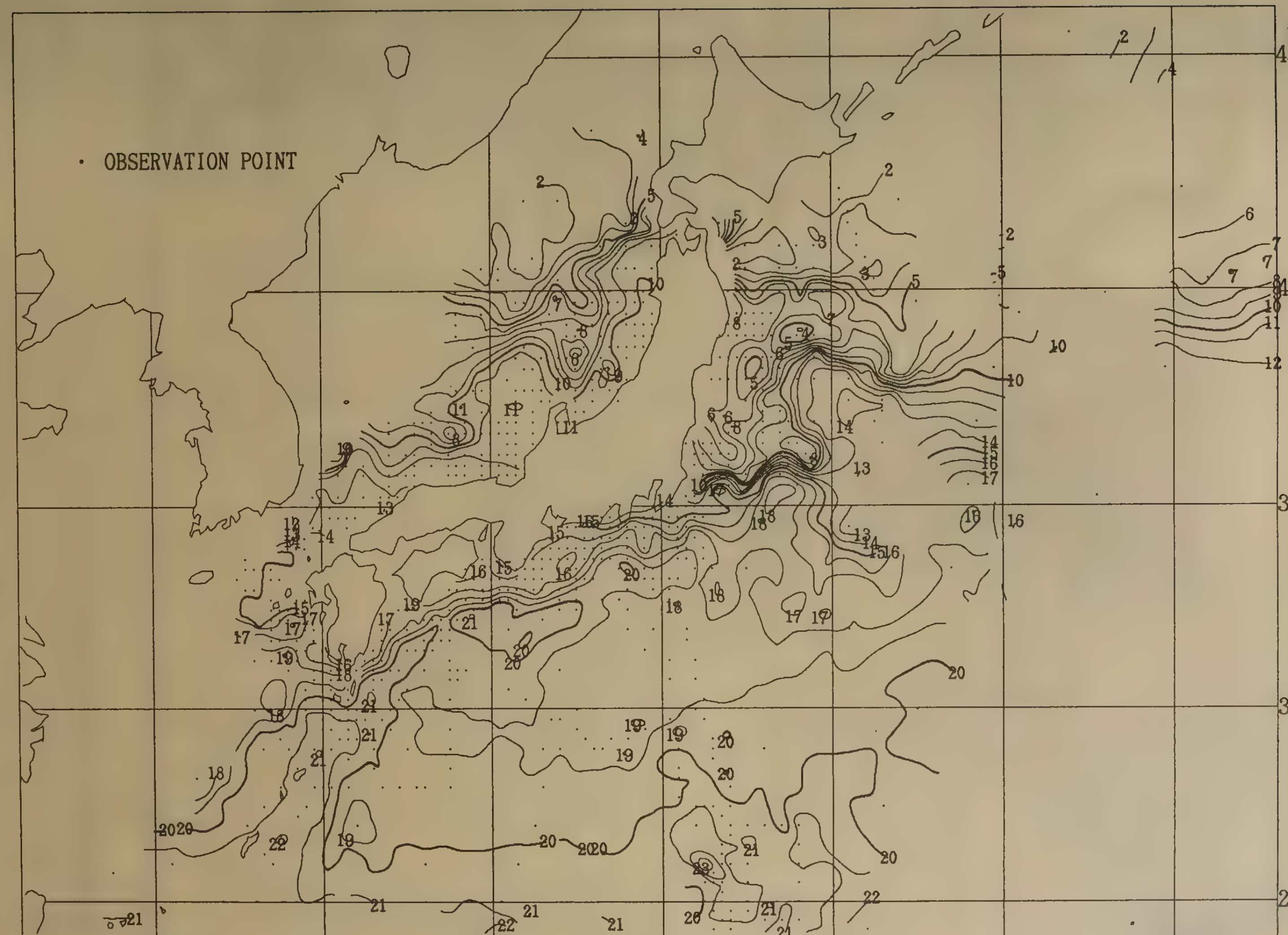
第17図 北西太平洋月平均海面水温図(上)及び偏差図(下)(1993年 3月)

Fig.17 Monthly mean SSTs in the western North Pacific (top) and anomalies (bottom) for MAR 1993. Anomalies are computed with respect to the JMA climatology (1961–90). The contour interval is 1° C and additional anomaly contours of 0.5° C are shown. Negative anomalies are stippled.



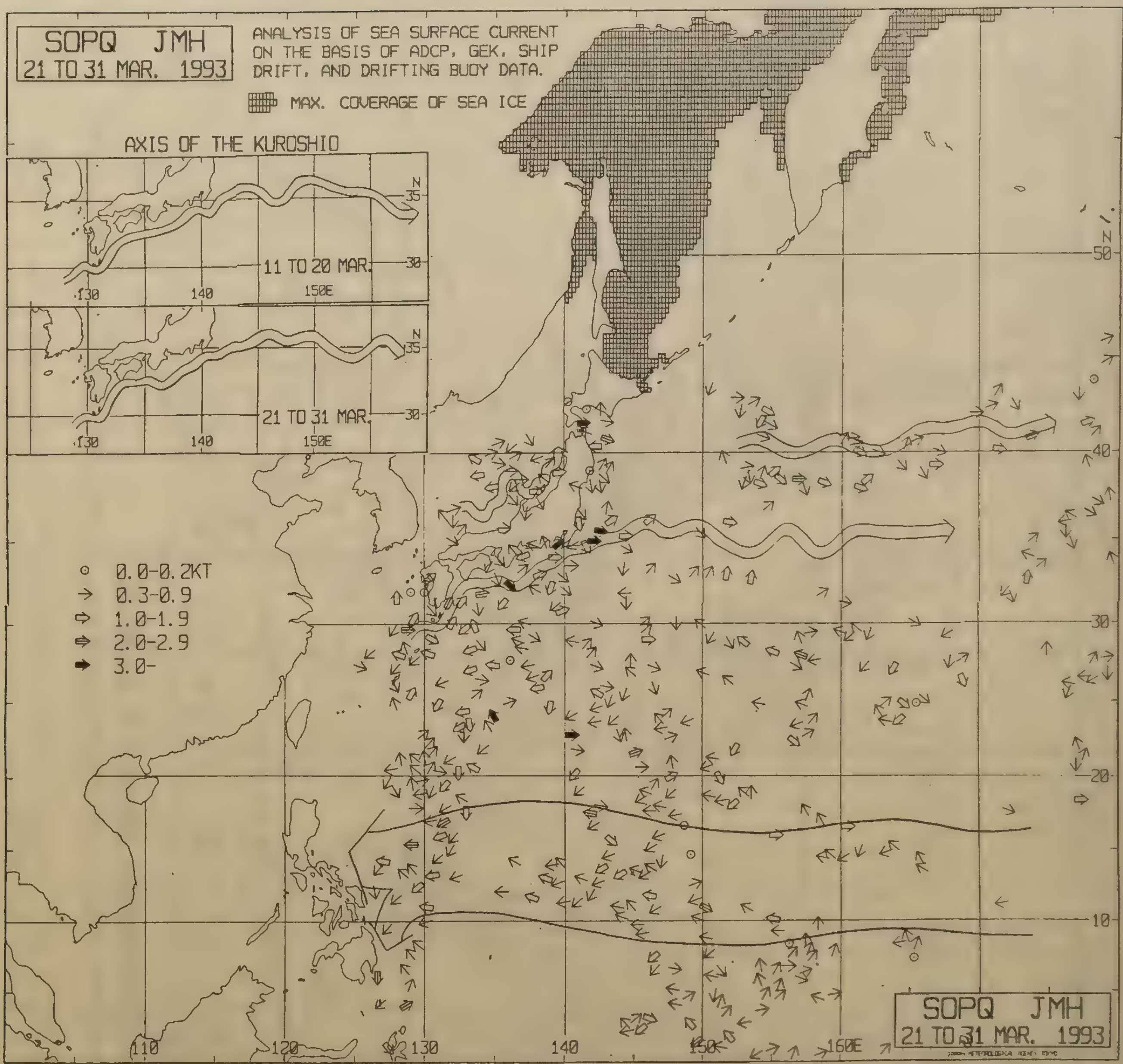
第18図　北西太平洋旬平均海面水温平年偏差時系列図

Fig.18 Time series of the ten-day mean sea surface temperature anomalies (° C) in the western North Pacific for the areas indicated at the bottom. Negative anomalies are shaded. Anomalies are computed with respect to the JMA climatology (1961−90).



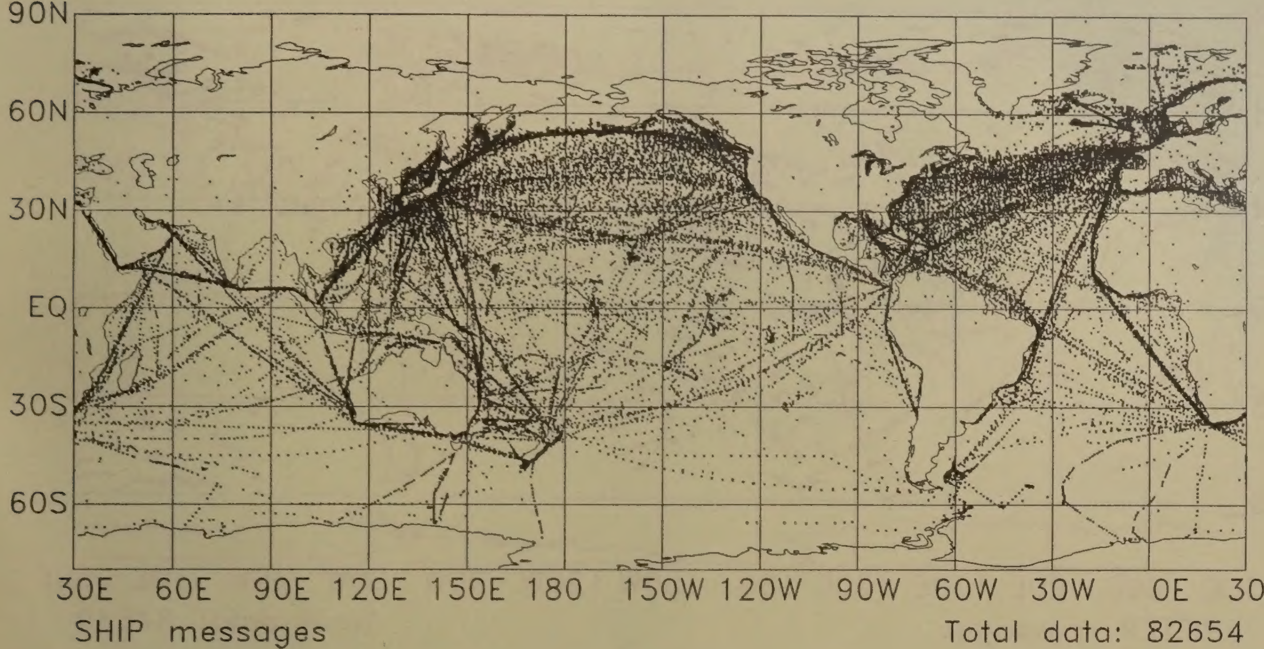
第19図　日本近海表層水温（深さ100M）図（1993年 3月）

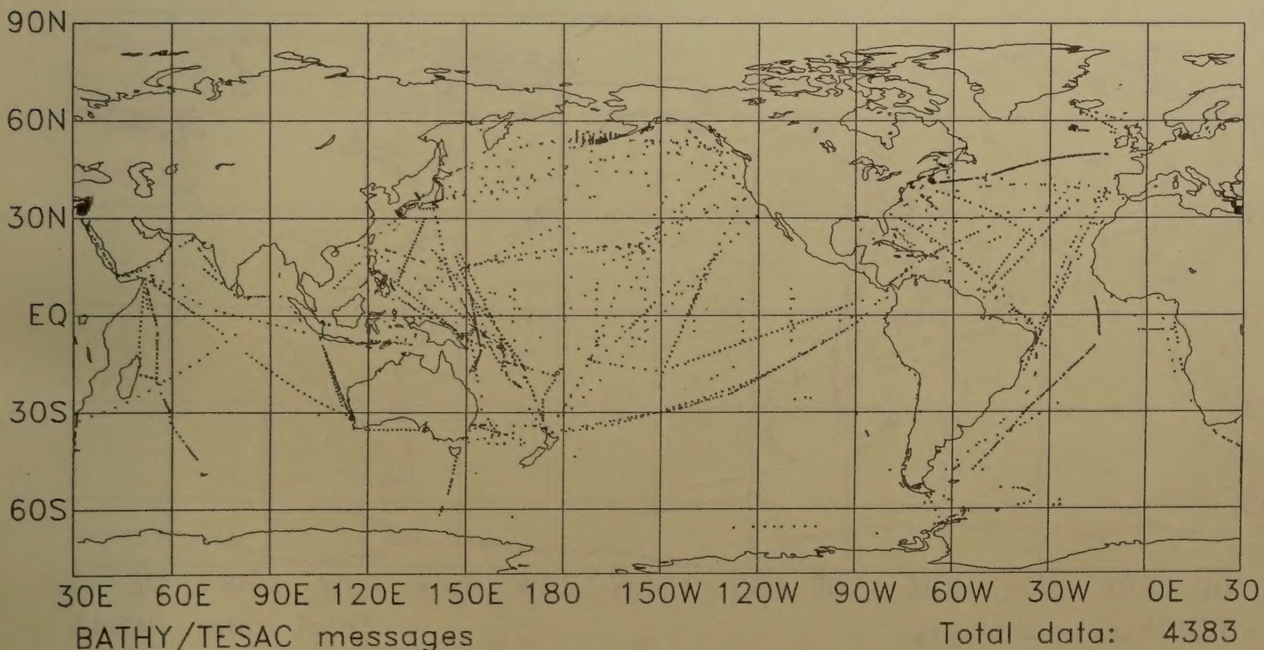
Fig.19　Subsurface (100m) temperatures in seas adjacent to Japan for MAR 1993.



第20図　北西太平洋旬平均海流図（1993年 3月下旬）

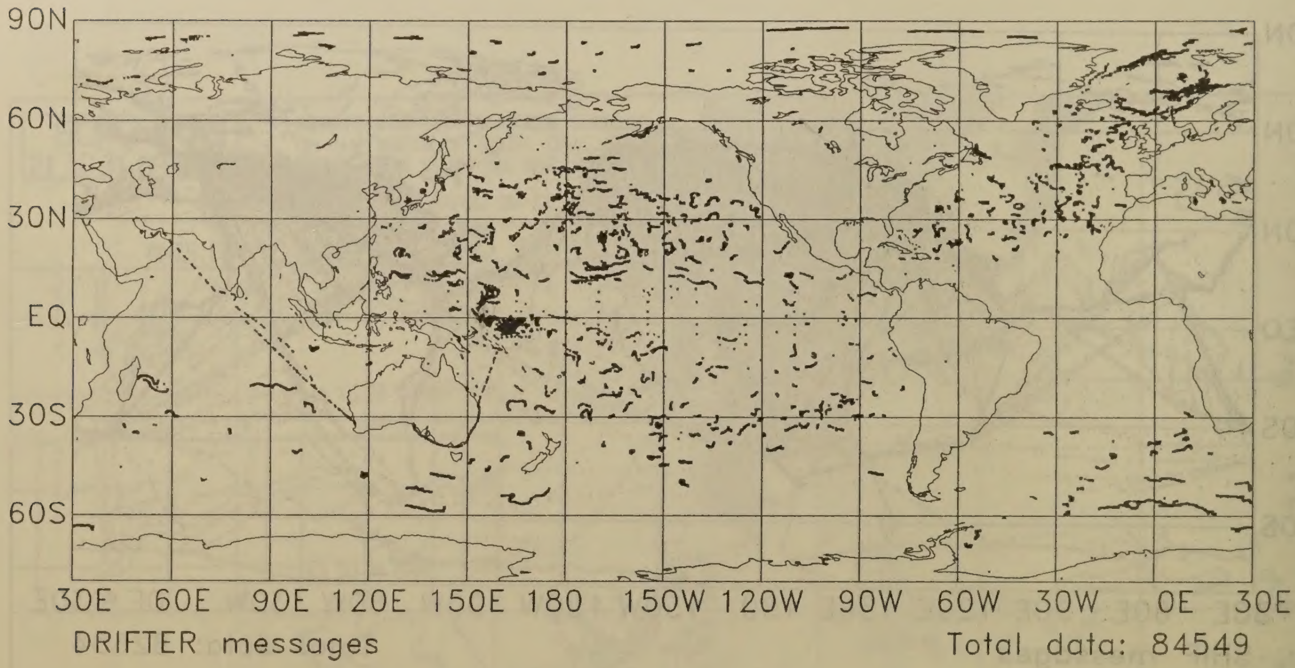
Fig.20 Ten-day analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in MAR 1993. Small arrows indicate sea surface currents measured with acoustic Doppler current profilers, GEKs deployed in research vessels, and ship drift by merchant ships/drifting buoys during the month. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.

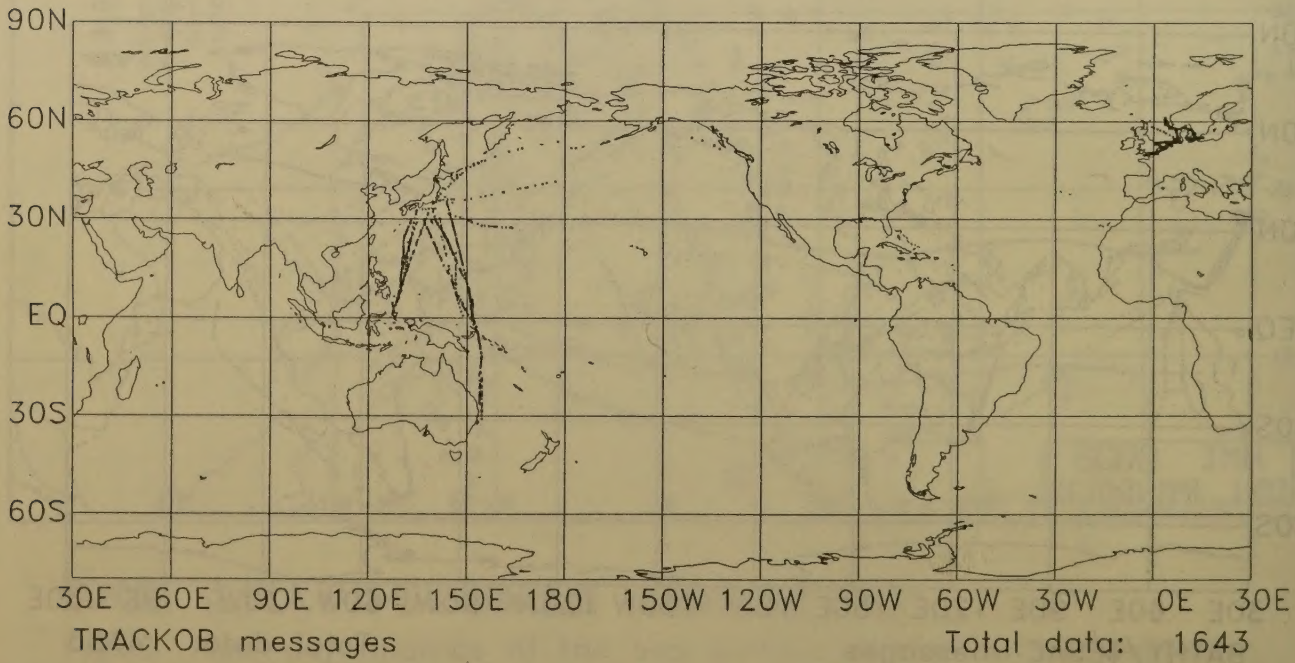




第21-1図　測点分布図(1993年 3月)

Fig.21-1 Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for MAR 1993.





第21-2図　測点分布図(1993年 3月)

Fig.21−2 Geographical distribution of DRIFTER messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for MAR 1993.

気象庁海洋月報

Monthly Ocean Report

March 1993 (No.3)

平成５年４月１７日発行

編集兼発行所　気象庁
東京都千代田区大手町 1-3-4

印刷所　株式会社東京プリント
東京都港区西新橋 3-24-9